UKAS UCL 2017

UK Archaeological Science Conference
5th - 8th April 2017
University College London

Welcome

We are delighted to welcome you to the 2017 UK Archaeological Science Conference, held at University College London. UKAS is the largest archaeological science focused conference in the UK and building on previous UKAS conferences, this year we're welcoming 190 delegates from more than 25 different countries.

Located in central London, UCL is ideally placed to hold this year's UKAS conference. UCL was founded in 1826, becoming the first university in England to admit students regardless of race or religion, and in 1878, gender. The university has a long tradition of supporting research-led archaeological training, with the establishment of the Petrie Museum of Egyptian Archaeology in 1892 and the founding of the Institute of Archaeology in 1937. Today, the UCL Institute of Archaeology has a large Archaeological Science section with expertise spanning a range of fields including bioarchaeology, materials science, geoarchaeology, archaeobotany and computational modelling.

We very much hope you enjoy the wide range of research presentations and social events that make up the UKAS 2017 programme.

Sponsors and Exhibitors

UKAS 2017 could not have been possible without the support generously offered to us by our sponsors: the Association for Environmental Archaeology, the Journal of Archaeological Science, OEA Labs, Oxbow Books and the Society for Archaeological Sciences.

We would also like to warmly welcome Archaeopress, BAR Publishing, Quest, and Sercon to UKAS 2017 as conference exhibitors. Their exhibition stands are located in the South Cloisters.

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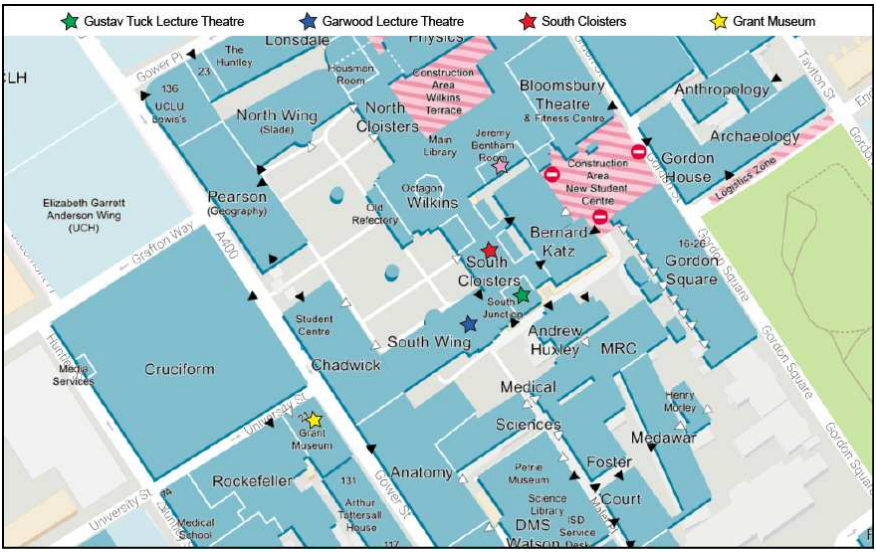
Contents

Venue Information

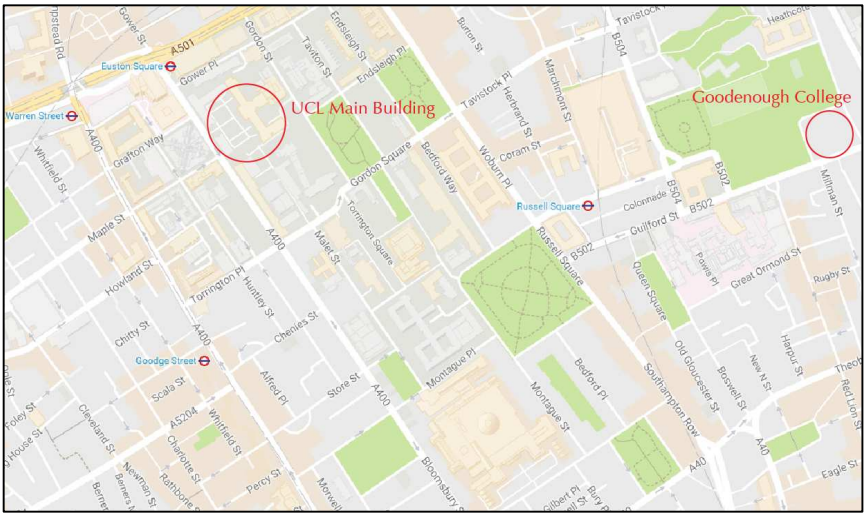
All daytime conference proceedings will take place in the Main Building, UCL. Oral presentations will take place in the Gustav Tuck Lecture Theatre, with overflow space available in the Garwood Lecture Theatre. The registration desk, social space and Friday evening poster session will be located in the South Cloisters. Lunch and tea breaks will also be held in the South Cloisters.

To access the Main Building, enter the UCL campus through the main gates on Gower Street, opposite the Cruciform building. The entrance to the south cloisters is to the right of the domed Wilkins Building. The Gustav Tuck Lecture Theatre is in the South Junction of the Main Building, adjoining the South Cloisters, on the 2nd floor. The Garwood Lecture Theatre is in the South Wing of the Main Building, on the 1st floor.

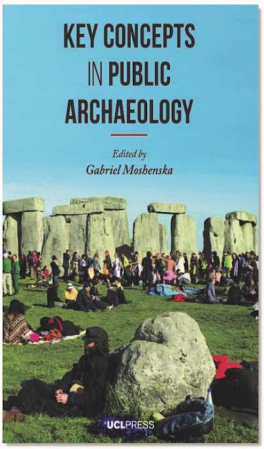


The wine reception will take place in the Grant Museum of Zoology. It is located on Gower Street. Exit the UCL campus through the main gates, and cross the road. The museum is on the corner of Gower Street and University Street.

The conference dinner will take place at Goodenough College, located on Mecklenburgh Square, which is about a 15-20 minute walk from the UCL Main Building. The nearest tube station to Goodenough College is Russell Square.



Should you require further directions or have any other questions, please look out for the UKAS committee and volunteers, who can be identified by their green UKAS t-shirts and/or red lanyards, and will be happy to help.



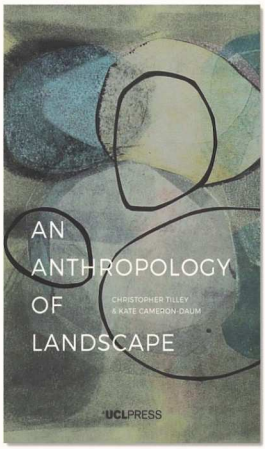
Key Concepts in Public Archaeology

Edited by Gabriel Moshenska

This textbook provides a broad overview of the key concepts in public archaeology, a research field that examines the relationship between archaeology and the public, in both theoretical and practical terms. Written for students and practitioners, the individual chapters – which can be read independently – provide textbook-level introductions to the themes, theories and controversies that connect archaeology to wider society, and point readers to relevant case studies and learning resources to aid further study.

This book is published as a 'living book' on UCL Press's innovative digital platform. The first nine chapters are published in February 2017, with further chapters being added over the following months, to form an ongoing and developing resource on this fascinating topic.

View online at www.ucl.ac.uk/ucl-press



An Anthropology of Landscape

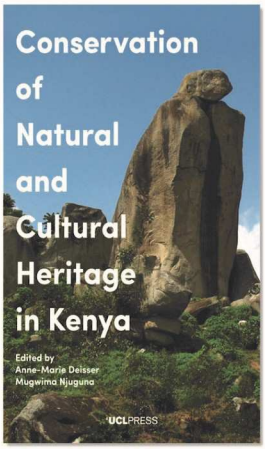
Christopher Tilley and Kate Cameron-Daum

Anthropology of Landscape tells the fascinating story of a heathland landscape in south-west England and the way different individuals and groups engage with it.

Based on a long-term anthropological study, the book emphasises four individual themes: embodied identities, the landscape as a sensuous material form that is acted upon and in turn acts on people, the landscape as contested, and its relation to emotion.

PB: 978-1-911307-44-0
February 2017 | 346 pp | £22.99

Download free PDF from www.ucl.ac.uk/ucl-press



Conservation of Natural and Cultural Heritage in Kenya: A Cross-Disciplinary Approach

Edited by Anne-Marie Deisser and Mugwima Njuguna

This book brings together essays by heritage experts from a range of disciplines to explore three key themes: the underlying ethics, practices and legal issues of heritage conservation; the exploration of architectural and urban heritage of Nairobi; and the natural heritage, landscapes and sacred sites in relation to local Kenyan communities and tourism.

PB: 978-1-910634-83-7
October 2016 | 228 pp | £18.99

Download free PDF from www.ucl.ac.uk/ucl-press

Information for delegates presenting

Podium presentations

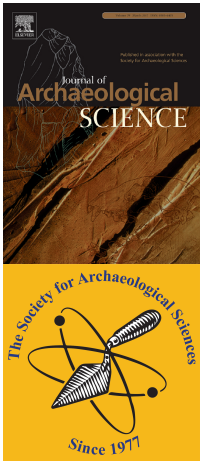
Each podium presentation slot will last for a total of 15 minutes. We recommend that presenters talk for 10-12 minutes, allowing 3-5 minutes for questions. A Windows PC will be available for use in the Gustav Tuck Lecture Theatre. Presenters should bring with them their presentation slides on a USB device and ensure they are uploaded onto the Lecture Theatre computer before the start of their session. One of the UKAS organisers will be available to assist with this. Please note, to ensure a timely switch over between presenters, we are unable to offer the opportunity for presenters to use their own laptops. The computer in the Lecture Theatre has a standard range of presentation software available. We recommend that presentations are formatted either as a PDF or Powerpoint file.

Poster presentations

Posters can be displayed as soon as you have registered your arrival, and poster boards will remain in place until the close of the poster session on Friday evening. Each poster has been allocated a numbered board. Please ensure you place your poster in the correct position. We suggest that presenting authors spend time at their poster during the poster session to discuss their research with other delegates and field any questions. Posters must be removed after the poster session has ended. After this time, we will remove any remaining posters from the boards. Space permitting, these will be stored at the registration desk until the close of the conference, but we cannot guarantee we will be able to hold on to them after this time. Posters can be A1 portrait or landscape, or A0 portrait (although this option will result in a 18cm overhang at the bottom of the poster board).

Prizes

Thanks to the generous support of our sponsors we are able to offer a number of prizes for outstanding presentations. Journal of Archaeological Science sponsored prizes will be awarded to the 3 best student podium and student poster presentations. Two prizes for early career researchers will also be awarded: The Society for Archaeological Sciences Early Career Researcher Award - Poster and The Society for Archaeological Sciences Early Career Researcher Award – Presentation. Winners will be announced at the close of the conference.



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* Offer valid until 30/04/2017

Conference Schedule

Wednesday 5th April

12:30	Registration desk opens	South Cloisters
13:25 – 13:45	Welcome	Gustav Tuck & Garwood LT
13:45 – 17:45	Session: People, Landscapes and Environments	Gustav Tuck & Garwood LT
18:00 – 20:00	Wine Reception *Sponsored by AEA and Oxbow Books*	Grant Museum

Thursday 6th April

09:30 – 13:00	Session: Globalisation and Connectivity	Gustav Tuck & Garwood LT
13:00 – 14:15	Lunch	South Cloisters
14:15 – 18:00	Session: Subsistence and Consumption	Gustav Tuck & Garwood LT
19:00	Conference Dinner	Goodenough College

Friday 7th April

09:45 – 13:00	Session: Populations and Lifeways	Gustav Tuck & Garwood LT
13:00 – 14:15	Lunch	South Cloisters
14:15 – 18:00	Session: Procurement and Production	Gustav Tuck & Garwood LT
18:00 – 20:00	Poster Session *Sponsored by OEA Labs*	South Cloisters

Saturday 8th April

09:15 – 12:45	Session: Animal-Human Interactions	Gustav Tuck LT
12:45 – 13:00	Closing remarks and prize awards: *Journal of Archaeological Science student podium and poster prizes.* *The Society for Archaeological Sciences Early Career Researcher Award – poster and presentation*	Gustav Tuck LT

Podium Presentation Schedule

Start	Page	Talk
Wednesday 5th April		
13:25	Rhiannon Stevens: *Introduction*	
13:30	Sue Hamilton: *Welcome from the Director of UCL's Institute of Archaeology*	
Session: People, Landscapes and Environments		
13:45	22	Jason Laffoon: *Provenancing People: Testing Probabilistic Assignments of Geographic Origins using Dual-Isoscapes*
14:00	23	Jane Evans: *Biosphere mapping - the next step*
14:15	24	Catherine Barnett: *The birth of an oppidum. The application of prospective and analytical techniques to landscape scale questions.*
14:30	25	Eduardo Machicado: *Pre-Columbian forest clearing, monumentality, and ADE formation in Western Amazonia: The geo-archaeology and micromorphology of human settlement in San Ignacio de Moxos (Eastern Bolivia)*
14:45	26	Ana B. Marín-Arroyo: *Understanding the impact of MIS3 climatic and environmental changes on human subsistence in Iberia*
15:00	27	Rhiannon Stevens: *UPNORTH: after the big freeze*
15:15	87	Nelis Drost: *Contrasting the influence of factors shaping the spread of early farming using an adapted cultural dissemination model*
15:30	**BREAK**	
16:15	28	Alessio Palmisano: *Long-term population dynamics and settlement patterns in the Mediterranean basin: the case study of central Italy.*
16:30	29	Katie Manning: *Mapping ecological change in the Holocene African Human Period – new results from the Green Sahara project*
16:45	30	Judith Sealy: *Reconstructing marriage patterns from dentine/bone comparisons: a case study from southern Africa*
17:00	31	Gianni Gallello: *Testing the capability of Rare Earth Elements to identify archaeological strata in an African site: The case of the terraced landscape at Konso, Ethiopia*
17:15	32	Charlene Murphy: *Drawing a thin line: Seed coat thinning during domestication of horsegram (Macrotyloma uniflorum) documented by synchrotron tomography of archaeological seeds*
17:30	33	Elizabeth Stroud: *Chalcolithic agricultural practices on the Anatolian plateau: investigating crop husbandry through a multi-stranded approach*
Thursday 6th April		
Session: Globalisation and Connectivity		
09:30	34	David Edge: *Trans-European co-operation in the neutron analysis of historic museum artifacts (arms and armour)*
09:45	35	Jonathan Wood: *Iridium to provenance ancient silver*
10:00	36	John Meadows: *Radiocarbon dating pottery food-crusts − pragmatic or problematic?*
10:15	37	Beatriz Bastos: *More than pottery: organic residue analysis of pottery vessels applied to the understanding of identity in Early Iron Age Europe*

Start	Page	Talk
10:30	38	Diane Lister: *Barley heads east − an archaeogenetic study of the spread of agriculture across Eurasia*
10:45	39	Ophalie Lebrasseur: *Ancient Genetics of the Domestic Chicken in Europe: Success Rate, Genetic Diversity and Implications*
11:00	**BREAK**	
11:30	40	Liisa Loog: *Estimating Mobility Using Sparse Data: Application to Human Genetic Variation*
11:45	41	Ammielle Kerudin: *Genotyping of Mycobacterium leprae ancient DNA*
12:00	42	Hannah Ryan: *Analysis of parasite DNA for understanding human migration*
12:15	43	Evan Irving-Pease: *Genetic analysis of the dwarf shorthorn cattle of Socotra reveals unique ancestry pattern*
12:30	44	Sue O'Connor: *Late Pleistocene/early Holocene maritime interaction in the southeastern islands of the Wallacean Archipelago*
12:45	45	Christopher Dunmore: *Archaeological Epistemology: A Citation Network Analysis of Lithic Microwear Research*
13:00	**LUNCH**	
Session: Subsistence and Consumption		
14:15	46	Klervia Jaouen: *Zinc isotope compositions of bone and dental enamel as a palaeodietary indicator*
14:30	47	Ji Young Shin: *Status-related dietary signal recorded in bone and dentine collagen from the fifth century Gyeongsan Imdang site in Korea*
14:45	48	Chelsea Budd: *A Relationship between Diet and Burial Rite at Neolithic* Osłonki 1: $\delta^{13}C$ and $\delta^{15}N$ studies
15:00	49	Jane Gaastra: *Divergent variation in the spread of the Neolithic: a combined meta-analysis of south-west Asia and Europe*
15:15	50	Terry Brown: *Ancient DNA from charred grain − elusive but tractable*
15:30	51	Keri Brown: *Tales of the unexpected results: Ritual complexity in a past community revealed by ancient DNA analysis of pre-colonial terracotta items from Northern Ghana*
15:45	**BREAK**	
16:30	52	Richard Madgwick: *The Dietary Impact of the Norman Conquest: A multi-proxy study on Oxford*
16:45	53	Caitlin Greenwood: *Meat Market: Organic Residue Analysis of Food Consumption at Corinium*
17:00	54	Alejandra García García: *Alimentary patterns in the life and death of a Bronze Age settlement. The analysis of organic residues of ceramic vessels in Peíalosa (Jaén, Spain)*
17:15	55	Adrián Mora-González: *Agriculture and production at the site of Terlinques (SE Iberian Peninsula): $\delta^{13}C$ and $\delta^{15}N$ results in cereal seeds*
17:30	56	Eloísa Ferratges: *Approach to the study of burned bones through Infrared Spectroscopy FTIR − ATR*
17:45	57	Tom Gardner: *Black as they're painted? Micromorphological appreciations of Orcadian burnt mounds and their associated soils as a proxy for depositional patterns.*
Friday 7th April		
Session: Populations and Lifeways		

Start	Page	Talk
09:45	58	Tamsin O'Connell: *Embracing isotopic variability – or why the mean is not enough*
10:00	59	Maura Pellegrini: *Spatio-temporal variation of tooth enamel phosphate oxygen isotopes in Britain*
10:15	60	Isabella von Holstein: *(ex)change and decay: $\delta^{18}O$ composition of archaeological collagen*
10:30	61	Nonhlanhla Dlamini: *Tracking Humans: A bio-archaeological approach to the history of pre-colonial populations in the Dogon Country (Mali)*
10:45	62	Andrew Millard: *Isotopic investigations of diet, weaning and 'stress' during the agricultural transition of the northern Atacama Desert*
11:00	**BREAK**	
11:30	63	Catherine Walker: *Reconstructing and Quantifying the Ohalo II Diet from archaeological and archaeobotanical data*
11:45	64	Patrick Flammer: *Molecular archaeoparasitology as a novel archaeological tool*
12:00	65	Tom Booth: *The Hole Story: Ancient DNA, stable isotope and radiocarbon analysis of human remains from the 'Mesolithic' cemetery at Aveline's Hole*
12:15	66	Alexander Peltzer: *MitoBench: An interactive visual workbench for population genetics on mitochondrial DNA*
12:30	67	Abigail Bouwman: *The Canopic Jar Project: an interdisciplinary study of ancient Egyptian soft tissue remains*
12:45	68	Stephen Kay: *Analytical techniques for the investigation of Roman funerary practices and population reconstruction. A case study from Pompeii*
13:00	**LUNCH**	
Session: Procurement and Production		
14:15	69	Eleanor Blakelock: *Secrets of the Anglo-Saxon goldsmith: Scientific results from the analysis of the Staffordshire Hoard gold*
14:30	70	Miljana Radivojevic: *Metals and networks on the steppes crossroads: Bronze Age metallurgy in Semirechye, Kazakhstan*
14:45	71	Xose-Lois Armada: *New insights into the technology and provenance of British Late Bronze Age metalwork: the Boughton Malherbe hoard (Kent)*
15:00	72	Samuel Elliot Harris: *Developing Archaeomagnetic Dating in the Scottish Neolithic: Geomagnetic variation in Orkney, Scotland*
15:15	73	Benjamin Gehres: *The raw material as an added value of ceramics?*
15:30	74	Margaret-Ashley Veall: *'What's black, sticky, and red all over?': An analysis of hafting adhesives in South Africa's Later Stone Age*
15:45	**BREAK**	
16:30	75	Melanie Roffet-Salque: *Towards the elucidation of the presence of long-chain fatty acids in archaeological lipid extracts from pottery*
16:45	76	Ben Stern: *Molecular composition, characteristics, intended use and degradation of contrasting large-scale organic residues*
17:00	77	Graeme Hansford: *The Application of a Completely Non-destructive High-Resolution X-ray Diffraction Technique in Cultural Heritage Science*
17:15	78	Laura Adlington: *The Ancestors of Christ from Canterbury Cathedral: An investigation of medieval stained glass window production by handheld pXRF*

Start	Page	Talk
17:30	79	Ana Franjic: *Long-distance trade in the Iron Age: Glass beads from Novo Mesto, Slovenia*
17:45	80	Kate Fulcher: *Painting Amara West − painting technology in ancient Sudan*
Saturday 8th April		
Session: Animal-human Interactions		
09:15	81	Michael Buckley: *A decade of Zooarchaeology by Mass Spectrometry (ZooMS)*
09:30	82	Kristine Richter: *Using the Other 90%: Identification of Fish Bones and Scales using ZooMS*
09:45	83	Alison Harris: *A Compound Specific Isotope Approach to Reconstructing Aboriginal Palaeodiet in Northeastern Canada*
10:00	84	Ella Assaf: *Human-horse interactions in the Paleolithic: Stories in the round*
10:15	85	Karen Milek: *New approaches to the origins of reindeer husbandry using integrated geoarchaeological and lipid biomarker analyses*
10:30	86	Shevan Wilkin: *Insights into dairying and diet in ancient Mongolia through the proteomic analysis of dental calculus*
10:45	**BREAK**	
11:30	88	Kevin Daly: *Ancient Whole Mitochondrial Genomes and Insights into the Prehistory of Goats*
11:45	89	Hugo Harbers: *Predicting archaeological boar's lifestyle from their remains: Calcaneum morphology as plastic marker of captivity*
12:00	90	Vanessa Navarrete: *Foddering strategies among the earliest pigs in the NE Iberian Peninsula (5700-4500 cal BC): a stable isotope perspective*
12:15	91	Petra Vaiglova: *Of Cattle and Feasts: using multiple isotopes to understand short- and long-term management patterns of animals consumed during feasts at Neolithic Makriyalos*
12:30	92	Victoria Mullin: *Understanding the herd: An ancient DNA study of the cattle of Cladh Hallan*
12:45	Rhiannon Stevens: *Student and ECR prize awards and closing remarks*	

List of Poster Presentations

Board	Poster
P1	Marisa Coutinho Afonso: *Shell mounds (sambaquis) and lithic artefacts: investigations in Southeastern Brazil*
P2	Eva Alarcón García: *Consumption and ritual practices in Biniadris cave (Alaior, Mahon, Spain)*
P3	Anthony Barham: *Sediment accumulation and removal from cave stratigraphies - the importance of identifying stratigraphic residuality when interpreting people-landscape interactions preserved in caves in tropical Southeast Asia*
P4	Anna Bini: *Bioarchaeology: Living And Death Of A Farming Society In Sardinia, Italy (AD 1300- 1700)*
P5	Magdalena Blanz: *Identification of seaweed consumption in sheep based on the concentration and distribution of arsenic in teeth*
P6	Tom Booth: *Long Live the Seaweed-Eaters: Radiocarbon and stable isotope analysis of human remains from the Neat's Court round barrow on the Isle of Sheppey, Kent*
P7	Tom Booth: *X-Ray Vision: The use of micro-CT as a non-destructive method of analysing bone diagenesis and its application to the identification of Romano-British stillborn infants*
P8	Robert Carracedi Recasens: *Beyond the underground. An archaeo-social analysis for mortuary practices among Hunter Gatherer*
P9	Maria Ana Correia: *Can we detect lake fishers? Using multiple modern human isotope signals to identify diet in tropical African populations*
P10	Steven Crabb: *What commercial archaeology can offer to archaeometallurgy: a case study of iron smelting*
P11	Danni Croucher: *A modern conflict: Archaeological theory, violence and the vacuum of gender archaeology*
P12	Ana Curto: *Diet in a Templar town: Medieval Portuguese diet from carbon and nitrogen stable isotope ratios*
P13	Beata Czajkowska: *The identity of the mysterious 'new glume wheat' of early European agriculture*
P14	Orsolya Czére: *Fishy Ways of Grey: A Multi-Isotope Study of Diet and Mobility at the Medieval Franciscan Friary, Aberdeen*
P15	Frank DiRenno: *Dying in the Neolithic: isotope analysis of the Late Neolithic mass grave of La Sagrera, Barcelona*
P16	Alice Dowsett: *Reconstructing palaeoenvironments in archaeology: The foraminifera and ostracods of the Burtle Beds, Somerset, during MIS 5e*
P17	Katharina Dulias: *Disentangling the expansion of major European mitochondrial DNA lineages*
P18	Gersande Eschenbrenner Diemer: *TRACER ("Tree Roots: an analytical 'culture' of economy and religion- case-study Egypt 2050-1550 BC") Presentation of an archaeometric project in Egyptology*
P19	Geraldine Fahy: *Bone deep: stable nitrogen isotope ratios and histomorphometric measurements of bone remodeling within adult human skeletons*
P20	Yee Min Gan: *The peopling of Sabah, Malaysia through phylogenetic analysis: A literature review*
P21	Albert García-Piquer: *Intra-site analysis as an archaeological approach to social norms in Hunter-Gatherer societies: testing the ethnoarchaeological data of Tunel VII (Tierra del Fuego, Argentina)*

Board	Poster
P22	Ciara Gigleux: *Caribou and Climate Change: Reconstructing Rangifer Seasonal Biogeography in late Holocene Alaska using Intra-Tooth Isotope Analysis*
P23	Eric Guiry: *Isotopic evidence from archaeological fish shows significant environmental change in past Great Lakes ecosystem*
P24	Neeke Hammers: *Economic change and urban development in medieval Odense (Denmark)*
P25	Katie Hemer: *Oh we do like to be beside the seaside: A bioarchaeological study of the early medieval cemetery of St Patrick's Chapel, Pembrokeshire.*
P26	Joseph Hepburn: *A Systematic Review of Spatial and Temporal Change in Prehistoric Human Diets in British Columbia, Canada*
P27	Alex Jamieson: *The arrival of mountain hares to the Outer Hebrides of Scotland: an ancient DNA study*
P28	Theis Jensen: *Species Identification of Mesolithic Bone Revealed by Ancient Proteins*
P29	Maria Kouroutzi: *Mineralogical and chemical characterization of ceramic findings from a kiln/workshop in the small theatre of ancient Ambracia in Epirus,Greece*
P30	Ophélie Lebrasseur: *Europeans, Polynesians and Chickens: An archaeological and genetics approach to the natural and cultural history of chickens in South America*
P31	Jamie Lewis: *'A Pig of a Problem': Unpicking $\delta^{15}N$ trophic systematics at the individual amino acid level*
P32	Nidia Lisic: *17th century mass plague pit from the Bedlam burial ground- an isotopic study of diet*
P33	Liisa Loog: *Selection on a domestic chicken gene affecting reproduction and behavior coincides with medieval religious dietary reform*
P34	Marta Lorenzon: *Raw source materials in Minoan mudbrick production*
P35	Milan Markovic: *Technological characterization of molded Islamic pottery from Mértola (Portugal)*
P36	Patricia Martin: *Reconstructing the seasonality of occupations of El Mirador cave (Sierra de Atapuerca, Spain) during the Neolithic: isotopic evidences*
P37	Maja Miše: *Amphorae production in the Greek settlement Pharos (Hvar), Croatia: petrographic and chemical characterisation*
P38	Anna Moles: *Isotopic indicators of dietary change at Knossos under the Roman Empire.*
P39	Coral Montero Lopez: *Resources movement, paleodiet, and feasting: Reconstructing human-animal interactions at Chinikihá, Chiapas during the Late Classic Period using stable isotopes*
P40	Joanna Moore: *Investigating the effects of anthropogenic lead pollution on the health and mortality of sub-adults within the Roman Empire.*
P41	Auxilio Moreno Onorato: *The massive production and distribution of metal in the Bronze Age: the case of Peàalosa and the Argaric Culture in the Iberian Peninsula*
P42	Ole F. Nordland: *Technological Aspects of Iron Production at Skógar, Iceland AD 940-1305*
P43	Sarah Pederzani: *Method development in palaeoclimate and palaeoseasonality reconstruction using oxygen isotopic analyses of bioapatite phosphate of faunal remains*
P44	Alexander Peltzer: *Ancient Egyptian mummy genomes suggest an increase of Sub-Saharan African ancestry in post-Roman periods*

Board	Poster
P45	Tihomir Percan: *ST. CROSS: Hillfort Settlement in Istria (Croatia) at the End of the 2nd Millennium BC*
P46	Ivona Posedi: *Chemical mapping of glass corrosion layers by PIXE/PIGE*
P47	Ivona Posedi: *Archaeovitreology and current issues*
P48	Leonie Raijmakers: *A Parasite's Papuan Past: reconstructing age and origin of Plasmodium vivax malaria in Melanesia*
P49	Bryony Rogers: *Challenging the Assumptions in Isotopic Profiling of herbivore teeth: a modern comparative intra- and inter-lobe study of the Chillingham cattle*
P50	Amber Roy: *Using acetate to replicate ground and polished stone surfaces*
P51	Anne Kathrine Runge*: Identifying Dietary Reads in Dental Calculus*
P52	Izaskun Sarasketa-Gartzia: *Different People, Same Communities: a multi-isotope approach at the onset of social complexity in the Western Pyrenees (Basque Country, Spain)*
P53	Lisa-Marie Shillito: *Investigating The Nature And Timing Of The Earliest Human Occupation Of North America Using A Novel Integration Of Biogeochemistry And Micromorphology*
P54	Hayley Simon: *Mapping 450 year-old marine archaeological iron corrosion from the Mary Rose*
P55	Filomena Sirovica: *Prehistoric Drywall Architecture: Reconstruction of Form and Function*
P56	Christophe Snoeck: *New developments for the study of cremated bone in archaeological contexts*
P57	Carlos Tornero: *A modern red deer population from Spain investigated through intra-tooth sequential isotope ($\delta^{13}C$ & $\delta^{18}O$) and tooth microwear analyses: using data as palaeoecological and seasonality proxy*
P58	Valentina Torrisi: *A new interpretation of Villa della Farnesina wall paintings in light of earlier dating linked to Cleopatra's presence in Rome between 46 and 44 BC*
P59	Vanessa Villalba-Mouco: *Burial Caves, Shared Spaces. Subsistence And Territorial Mobility During The Neolithic In The North-East Iberian Peninsula: A Multi-Isotope Approach*
P60	Rachel Vykukal: *Lipid Analysis of Pottery from Ayia Triada Cave, Greece: Evidence for Ritualized Consumption?*
P61	Kate Welham: *Hotspots in the landscape: the application of geochemical and geophysical prospection to locate high-temperature production in early Islamic towns*
P62	Ashleigh Wiseman: *A three-dimensional geometric morphometric study of coastal erosion and its implications for biological profiling and biomechanical inferences of fossilised footprints from Formby Point, Merseyside*
P63	Megan Wong: *Characterizing Mobility in Times of Transition: An Investigation of Roman and Byzantine Populations at Hierapolis, Turkey*
P64	Hugo D Yacobaccio: *Climate change, rodents and camelids: Assessing subsistence strategies during the Early and Middle Holocene in the Dry Puna through stable isotope analysis*

Podium Presentation Abstracts

Provenancing People: Testing Probabilistic Assignments of Geographic Origins using Dual-Isoscapes

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The continued development of multiple isotope approaches has greatly contributed to geo-provenance research in a wide range of disciplines. The recent development of large-scale models of spatial isotopic variation (isoscapes) has further enhanced the capacity to investigate the geographic origins of a vast array of materials, animals and people especially in the fields of wildlife ecology and forensics. To date, the use of isoscapes for archaeological provenance studies has been rather limited owing, in part, to the general lack of accurate regional isoscapes for the relevant isotope systems that are most widely utilized in archaeological research, and limited frameworks for integration of multi-isotope data sets with their associated isoscapes. In order to develop more standardized and quantitative approaches to the geographic assignment of individual human origins, we applied a probabilistic assignment approach using probability density functions on dual-isotopic data and associated isoscapes ($^{87}Sr/^{86}Sr$ and $\delta^{18}O$) for the Circum-Caribbean region. We tested our approach on a modern human sample of known origin from Caracas, Venezuela and further explored it with archaeological samples of unknown origin. Validation tests on the known origin sample exclude most areas of the region and correctly highlight Caracas as a potential origin and clearly demonstrate the overall efficacy of the dual-isotope approach. The accuracy and utility of such approaches may be further improved by better understanding of the relationships between environmental and biological isotope variation; continued refinement of relevant isoscapes; and the incorporation of a broader range of isotope proxies.

Biosphere mapping- the next step

J. Evans[1]; C. Chenery[1]; C. Cartwright[2]; K. Lee[2]; K. Mee[2]; K. Royse[2]

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The current strontium isotope biosphere variation map of Britain has been well used (122 citations since publication in 2010) however it has limitations. These include: inconsistent data coverage; low number of samples; variable sample types; no assessment of robustness of the data distribution and boundaries; little account of effect of rain/seawater; little accommodation for superficial deposits such as glacial moraine; no estimate of how gradational the boundaries are and finally it is difficult to update when new data are generated. The "measure and match' approach, used in all the currently published Sr biosphere maps, gives no indication of the uncertainty inherent in creating the isotope domains. In order to address these issues NERC Isotope Geoscience Laboratory is collaborating with the British Geosocial Survey digital mapping group to developing a model of isotope biosphere variation based on the interaction of geological, climate and geographic contributions. The overall aim of this project is to develop an interrogatable multi-layer, multi-purpose resource for archaeological, environmental, food security and ecological studies by linking geographically distributed isotope variation with environmental data. This presentation will describe how this is being produced and what the final map will look like and how it will operate.

The birth of an oppidum. The application of prospective and analytical techniques to landscape scale questions

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[1] University of Reading, [2] Historic England

A broad range of scientific approaches have been applied to materials recovered through 20 years of excavations of the Iron Age and Roman town of Silchester and added enormously to our understanding of urban life and times. Less well understand is the landscape setting and human-environment relationships in the wider area which allowed the rapid establishment of such a significant place. The Silchester Environs Project is undertaking large scale prospective (AP, lidar, coring, geophysical and earthwork surveys) supported by excavation, multiproxy analysis and dating of sites in the surrounding 140kmsq to consider the evolution of the late prehistoric landscape, how it was divided, settled, managed and exploited and indeed what happened at and following the abandonment of the town. Preliminary results will be presented, including a critique of prospective methods and visibility issues born from the comparison of a series of techniques undertaken on highly uncooperative geologies and a discussion of the range of site types found despite them.

Session: People, Landscapes and Environments

Pre-Columbian forest clearing, monumentality, and ADE formation in Western Amazonia: The geo-archaeology and micromorphology of human settlement in San Ignacio de Moxos (Eastern Bolivia)

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The Llanos de Moxos (LDM) in Eastern Bolivia has become an important region for the assessment of human impact in the Amazon basin. Research in the region is still confronted in two diametrically opposed interpretations. Traditionally the extent and scale of drained field agriculture has been used as a marker of intensification and population density (Denevan 1966, Erickson & Balée 2006). Recent work has put this into question suggesting that, although impressive on the surface, these remains could actually be the result of a small mobile population spread over time (Lombardo et al. 2011, Rodrigues et al. 2014). An important gap in this research has been the study of domestic settlement. In this paper I present the results of a three year geo-archaeological project near San Ignacio de Moxos, southwest LDM. Data from two domestic sites strongly supports the model of population growth during Pre-Columbian times. Micromorphological samples provide striking examples of early forest disturbance, destabilization of soil structure, and monumental construction. Archaeological deposits show dramatic enhancements of Organic Material, P, S, $CaCO_3$, coming from human waste; in addition of elevated Magnetic Susceptibility values suggesting constant burning characteristic of the formation of Anthropogenic Dark Earth (ADE). Data from domestic sites provides an important aid to the interpretation of the social underpinnings behind the development of drained field agriculture. More importantly, the development of human occupation in the southwest LDM clearly exemplifies the complex interplay between environmental and anthropogenic factors in landscape development during Pre-Columbian times.

Session: People, Landscapes and Environments

Understanding the impact of MIS3 climatic and environmental changes on human subsistence in Iberia

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Throughout the Middle to Upper Palaeolithic transition, during MIS3, the Vasco-Cantabrian Region in northern Iberia was archaeologically important within Europe, and can be studied to unravel the factors that led to the extinction of the Neanderthals, and their replacement by Anatomically Modern Humans (AMH). Climate change has been proposed, among other causes, as one of the main driving forces behind the demise of Neanderthals. In this region, most of the information about human behaviour and economic adaptations comes from lithic assemblages and technological studies. The relationship between humans and the environmental conditions they coped with, and how these affected their economic decisions, has previously not been systematically approached, and there is a lack of a continuous, fine-grained and well-dated terrestrial palaeoclimatic datasets. To address this gap in knowledge, we undertook stable isotope analyses ($\delta^{13}C$ and $\delta^{15}N$ and $\delta^{34}S$) on hunted ungulates, in addition to ^{14}C dating to create a continuous chronological sequence of the environmental conditions across the Vasco-Cantabrian Region. The isotopic values are correlated with the palaeoeconomic information obtained from the faunal assemblages accumulated by both human species, and their behavioral flexibility and resilience are evaluated. This is the first multidisciplinary isotopic study in the region. Results show that despite the climatic oscillations Neanderthals and AMH were successfully adapting their subsistence practises, although throughout several warm episodes during the Aurignacian a better adaptability of AMH is observed.

UPNORTH: after the big freeze

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The UP-North project examines the recolonisation of Northern Europe after the last glacial maximum. As people move eastwards and northwards to colonise uninhabited landscapes, increasing diversification is seen in their stone and bone tool industries. UP-North is exploring the relationship between this human dispersal, cultural development and climate change. Through radiocarbon dating, stable isotope and DNA analyses we aim to create an integrated chronological, palaeoclimatic and palaeoecological frameworks that is directly linked to the Late and Final Palaeolithic archaeological record.

Here we present an examination of the reoccupation of what is now the British Isles by Late and Final Palaeolithic populations, which started shortly before the onset of the Late Glacial Interstadial warming event. We explore the spatial distribution of known Late and Final Palaeolithic find locations in the British Isles and consider the radiocarbon record of human presence in the region. Using stable isotope data we explore the environmental setting of several archaeological sites including King Arthur's Cave, Gough's Cave, Kent's Cavern and Mother Grundy's Parlour, and discuss how incorporating an environmental perspective may assist in interpreting the archaeological record of recolonisation, particularly when chronological context is ambiguous.

Long-term population dynamics and settlement patterns in the Mediterranean basin: the case study of central Italy

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The 'Changing the Face of the Mediterranean project' is a Leverhulme-funded Plymouth-UCL collaboration which aims to reconstruct long-term trends in population dynamics and vegetation change from the introduction of Neolithic farming to Medieval times (ca. 9000-1000 BP), on a pan-Mediterranean scale, in order to assess if and how human impact has shaped natural landscapes over the millennia. In the present paper, we compare radiocarbon summed probability distributions, archaeological site counts and site sizes from central Italy (Tuscany, Lazio) in order to understand how human demography changed over the longue durée. These three proxies have never been applied to the same case study and their application provides further insights towards a better understating of the processes determining regional settlement demography and settlement patterns. All proxies roughly produce similar patterns from the Late Mesolithic to the fall of the Roman empire, and where they diverge (e.g. Late Bronze Age/Iron Age) they show shifts in spatial settlement patterns (e.g. nucleation vs dispersion). The results raise further awareness how some of the previously-emphasized methodological challenges associated with these datasets can be overcome.

Session: People, Landscapes and Environments

Mapping ecological change in the Holocene African Human Period – new results from the Green Sahara project

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Whilst the Holocene AHP is perhaps one of the most thoroughly documented and well-dated climate change events, the rate of change to the terrestrial environment, its spatial distribution and ecological implications for human settlement are poorly understood. In this paper we present preliminary results from the Green Sahara project, using compound-specific carbon ($\delta^{13}C$) and deuterium (δD) isotopes from organic residues, in conjunction with new, high resolution palaeohydrological maps, to reconstruct Holocene ecological change in the Fezzan, southwestern Libya. We also present a new population density curve, using summed probability distributions of radiocarbon data, to explore the consequences of ecological change for human settlement in the region.

Reconstructing marriage patterns from dentine/bone comparisons: a case study from southern Africa

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Recent work on Late Holocene forager communities on the South African coast has demonstrated the presence of sedentary or near-sedentary communities, as seen along productive coastlines elsewhere in the world. The Robberg Peninsula and adjacent Plettenberg Bay offered especially rich marine foraging opportunities, including access to a mainland seal colony and highly productive localities for shore-based fishing, leading to very high $\delta^{15}N$ values in human bone collagen. In contrast, contemporary skeletons from Matjes River Rock Shelter, 14 km to the east, have lower $\delta^{15}N$ values, indicating less reliance on high trophic level marine foods. Such a marked discrepancy indicates significantly different marine foraging strategies: in effect, an economic difference between the two sites resulting from segregation of the two communities. The estuary of the Bietou/Keurbooms River probably marked the boundary between two hunter-gatherer territories. New research compares $\delta^{15}N$ in the dentin of early-forming permanent teeth (incisors and first molars) with bone from the same skeletons, in order to ascertain whether people from Robberg/Plettenberg Bay married within their own group (in which case both dentin and bone should show high $\delta^{15}N$), or whether they sought marriage partners from further afield (in which case $\delta^{15}N$ in dentin should be lower than in bone). The data set available thus far supports within-group marriage. This raises interesting questions about group size (how large did groups have to be to maintain long-term viability?) and the nature and extent of regional networks at this time.

Testing the capability of Rare Earth Elements to identify archaeological strata in an African site: The case of the terraced landscape at Konso, Ethiopia

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Over the last twenty years Rare Earth Elements (REE) have started to be part of archaeometric studies. Due to their particular characteristics there have been several attempts to apply REE analysis to different archaeological scenarios including stratigraphically-controlled agricultural soils, demonstrating that this is an effective tool to understand how human activity is reflected in soil development. Our study proposes a new methodological approach for the identification of anthropogenic deposits through REE soil analysis, pushing current limitations of traditional chemical and sedimentology techniques. Our study represents the first application of REE concentrations in soils from tropical Africa within an archaeological context. The agricultural soils were captured in an artificial sediment trap that forms part of the terraced landscape in Konso, Ethiopia; a system thought to have developed over the last 500 years, and which was awarded World Heritage status in 2011. Forty samples were taken from successive alluvial layers down a c. 2m thick soil sequence that had accumulated behind a series of drystone walls. The samples were analyzed for trace elements and REE via ICP-MS. To understand the causes of enrichment or depletion of REE, the data were compared with soil organic matter, organic carbon and fire markers. To aid interpretation we cross-referenced our results with archaeobotanical and soil micromorphology data. Data were analysed using multivariate statistics. Taken together these results present a very different picture of landscape development to previous presented accounts; the REE analyses provide significant details regarding the source and transportation of sediments.

Drawing a thin line: Seed coat thinning during Domestication of horsegram (Macrotyloma uniflorum) documented by synchrotron tomography of archaeological seeds

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Horsegram has been an important crop since the beginning of agriculture in many parts of South Asia. Today it is a major vegetable protein source for hundreds of millions of Indians. Despite horsegram's beneficial properties as a hardy, multi–functional crop, it is still regarded as a food of the poor, particularly in southern India. As a consequence horsegram has received far less research than higher status pulses, such as Indian Vigna (V. radiata, V. mungo) or pigeonpea (Cajanus cajan). Hence, little scientific agrarian and archaeobotanical research has been carried out on this legume to date. To remedy this issue morphometric measurements, including length, width, and thickness were carried out on both modern and Indian archaeological assemblages of horsegram to determine evolutionary rates of change and patterns of domestication over time in an attempt to understand horsegram's evolutionary trajectory in South Asia. The archaeological documentation of domestication is often hampered by limited preservation of diagnostic morphology in archaeological plant specimens. To overcome this issue we used SEM to measure the seed coat thickness of dissected modern samples of Horsegram and high resolution x-ray computed tomography using a Synchrotron to measure coat thickness, undertaken at Diamond Light Source, UK, on intact archaeological samples of horsegram to examine rates of change in seed coat thickness in relation to domestication over time to determine if seed coat thickness is one of the phenotypic traits affected by humans' domesticating horsegram during the Neolithic (3rd - 2nd Millennium BC) in South Asia.

Chalcolithic agricultural practices on the Anatolian plateau: investigating crop husbandry through a multi-stranded approach

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This study investigates Chalcolithic central Anatolian crop husbandry through a combination of archaeobotanical evidence of crop abundance and functional weed ecology (cultivation intensity), and the complementary method of stable isotope analysis of carbon (water status) and nitrogen (soil N composition) from crop remains. Two case studies, the large Early Chalcolithic site of Çatalhöyük West (5900-5550 cal BC.) and the small Late Chalcolithic site of Çamlıbel Tarlası (3590-3470 cal BC.), provide an opportunity to investigate the comparative nature of agricultural practices during the Chalcolithic. Marcobotanical remains demonstrate regional differences; the inhabitants of Çatalhöyük West focused on a specific range of crop cultivars, while at the smaller (wetter) site of Çamlıbel Tarlası they experimented with numerous pulse cultivars. Functional weed ecology and crop stable isotope analysis shed light on distinctive management strategies for particular crops. Barley at Çatalhöyük West was grown in drier conditions than the wheats and the pulses, while the inhabitants of Çamlıbel Tarlası grew their crops across a range of conditions, with no specific species occupying the drier niche. Functional weed ecology indicates differences in the intensity of cultivation; fertility and disturbance ranged from relatively low to high at Çatalhöyük West, while at Çamlıbel Tarlası a cohesive set of crop husbandry techniques were practised. This study reveals that the crop husbandry practices at the sites differ, with environmental and social constraints playing an important role in shaping agricultural landscapes.

Trans-European co-operation in the neutron analysis of historic museum artifacts (arms and armour)

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For the past three decades objects in the Armoury of the Wallace Collection have been examined for cataloguing, focussing on the identification of materials and constructional techniques. For example, the manufacture and use of so-called watered 'Damascus' steel, also known as 'wootz', has long been imperfectly understood, suffering as it does from centuries of confused terminology and misunderstood technology. Wootz is a high-carbon crucible steel which can bear a variety of delicately 'watered' patterns on its surface, integral with the microstructure of the metal. Its highly specialised manufacture, almost unknown in medieval and Renaissance Europe, was the preserve of the Indian sub-continent, Iran, and Central Asia. A majority of our Indo-Persian blades and armour are (we think) made of wootz, although due to wear or often harsh and uncomprehending over-cleaning in previous centuries, many of these once-patterned surfaces have now been scoured bright. Similarly, armourers' marks struck into the surfaces of blades and armour have also been worn away and are now indecipherable. Techniques such as neutron diffraction and neutron imaging can provide a non-invasive means of identifying the presence of wootz or 'reading' worn-away makers marks and inscriptions on arms and armour. Thanks to the co-operation of institutions across Europe, neutron-based techniques have been successfully employed to study objects in the Armoury of the Wallace Collection, and it is the work of this network of dedicated researchers that will be described and evaluated in this paper.

Session: Globalisation and Connectivity

Iridium to provenance ancient silver

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Trace levels of iridium in ancient silver artefacts can provide information on the sources of silver-bearing ores as well as the technologies used to extract silver. A geographically and chronologically disparate legacy dataset, comprised of Near Eastern objects from the Sasanian and Byzantine Empires (1st Millennium AD) and coins circulating around the Mediterranean in the mid-1st Millennium BC, shows that Ag-Au-Ir log-ratio plots can identify silver derived from the same mining areas, as well as broadly differentiating between the ore types exploited. Combining trace element and lead isotope analyses through the Pb crustal age of the ore, further delimits interpretations on the compositions and locations of silver ore sources. Furthermore, it is shown that silver artefacts of Near Eastern origin have exceptionally high iridium levels, suggesting a unique silver-bearing ore source, potentially in the Taurus mountain range of southern Anatolia. The wide range of crustal ages identified for ancient Greek coins and Near Eastern objects suggest that the addition of exogenous lead as a silver collector during smelting was common practice in the Near East as early as 475BC. The practice of mixing silver from different sources has also been identified by triangulating the log-ratio subcomposition plots, Pb crustal ages of the ore from which the silver derived and absolute values of trace levels of gold and iridium in silver artefacts.

Radiocarbon dating pottery food-crusts − pragmatic or problematic?

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INDUCE, a 5-year programme of research on the function of early pottery, will use new AMS dates from food-crusts to refine the chronology of the spread of pottery types across a vast region, between the Urals and the Baltic. The first pottery in this region was made by hunter-gatherer-fishers, and appears to have been used mainly for cooking, as potsherds are often encrusted with carbonised food. Food-crust ^{14}C ages should date the last time a pot was used, but aquatic organisms are generally depleted in ^{14}C compared to terrestrial species, so samples containing carbon derived from aquatic food-chains can give misleadingly early dates. Thus we need to screen potential dating samples to select those containing little or no carbon of aquatic origin. Under the right preservation conditions, a high proportion of food crusts retain significant quantities of lipids, containing diagnostic biomolecules ('biomarkers'). EA-IRMS data may also inform the selection of suitable samples for ^{14}C dating. These methods appear to work when sample composition is sufficiently diverse, but we suspect that at many sites, nearly all potential ^{14}C samples contain some carbon of aquatic origin. In these cases, we need to understand the level and variability of ^{14}C depletion in local aquatic species, and our uncertainty in the aquatic carbon content of food-crusts, before we can use food-crust ^{14}C ages as anything more than termini post quos. We present examples of both situations, and discuss whether alternative approaches are even more problematic.

More than pottery: organic residue analysis of pottery vessels applied to the understanding of identity in Early Iron Age Europe

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The ENTRANS Project (Encounters and Transformations in Iron Age Europe) aims to expand our knowledge regarding the nature and impact of cultural encounters during the European Iron Age and their effect on the identity of Iron Age people. This project is focused in the south-east Alpine Region, which includes Slovenia and Croatia, since it is a point of cultural interaction between Mediterranean and temperate European societies. Complex trade routes connected different areas of the Alpine Region, bringing a wide variety of products for trade, which also contributed for the exchange of cultural practices, values, political and religious ideas. In order to explore these transformations, the ENTRANS Project was divided into three main topics of research: the body, landscape and art. The study of ceramic vessels was later included in the project, in order to further understand cultural practices in the East Alpine region. The identification of the resources cooked and/or stored in ceramic vessels can provide important information regarding the source and nature of cultural and social changes that took place in later prehistoric Europe.

This paper presents the results obtained from the analysis of absorbed organic residues of ceramic vessels from Early Iron Age sites in Slovenia and Croatia obtain through GC-MS. The principal aims are to explore aspects of diet and the provenance of resources and differences of use of the vessels between settlement and funerary contexts. This paper also demonstrates how organic residue analysis can show patterns of change and encounters during later prehistory.

Barley heads east − an archaeogenetic study of the spread of agriculture across Eurasia

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The spread of agriculture across Eurasia has been a topic of much interest in recent years; with the use of flotation at archaeological sites, along with radiocarbon dating of single seeds, an increasingly detailed picture is being built up of when and where certain crops were first cultivated by prehistoric farming communities. Genetic studies of extant crop landraces, or farmers' varieties, can add important data to this emerging picture. In this project, we are using the analysis of extant barley landraces to look at the spread of agriculture from the Near East eastwards across Eurasia. The landraces included in this study were originally collected during the early 20th century, before the advent of modern farming practices and commercial crop breeding programmes. We have analysed these landraces using neutral microsatellite markers, and the results have revealed putative migration pathways eastwards across Eurasia, which may reflect those used deep in prehistory. By studying the phenotypic characteristics of landraces, for example the prevalence of naked forms of barley on the Tibetan Plateau, we have an insight into how human choice influences the distribution of particular types. In addition, the analysis of variants in genes involved in environmental adaptation is revealing how alterations in flowering time pathways may have contributed towards the success or failure of crops as their cultivation spread into novel environments.

Ancient Genetics of the Domestic Chicken in Europe: Success Rate, Genetic Diversity and Implications

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Originating from Southeast Asia, chickens (Gallus gallus) are now found across the world, dispersed through human-assisted means. Because of their social significance among human societies and of their dispersal with human populations, their natural history reflect human history. Over the past 3 years, the AHRC-funded project entitled 'Cultural and Scientific Perceptions of Human-Chicken Interactions' has gathered (with the help of numerous European collaborators) over a 1000 ancient chicken bones from across Europe with the aim of investigating the chickens' natural and cultural history in the West. Over 200 of these bones were sent for ancient DNA analysis (among other investigations) with the aim to investigate the genetic diversity of domestic chickens from their arrival in Europe over 2000 years ago to the present day, and consequently establish the introductions and movements of chicken populations. This represents the first comprehensive ancient chicken genetic dataset available for Europe. Based on the DNA screening results of over 200 ancient chicken bones and nearly a 100 modern feathers from recognised breeds, this presentation will provide the success rate of the DNA extraction conducted on these ancient bones, and retrace haplogroup distribution through time and space. While results are mostly confirming what was previously thought, a few findings question the possibility of modern intrusions in archaeological contexts.

Estimating Mobility Using Sparse Data: Application to Human Genetic Variation

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Mobility is one of the most important processes shaping spatiotemporal patterns of variation in genetic, morphological and cultural traits. However, current approaches for inferring past migration episodes in the fields of population genetics and archaeology have several shortcomings. They lack either temporal resolution or formal quantification of the underlying mobility, are all poorly suited to spatially and temporarily sparsely sampled data, and do not permit systematic comparison between different time periods or geographic regions. To overcome these problems, we present a new estimator of past mobility, particularly suited to sparsely distributed morphological, cultural or genetic variation data. We show the efficacy of this estimator using spatiotemporally explicit simulations and apply it to ancient genomic data from Western Eurasia. We identify a sequence of changes in human mobility from late Pleistocene to the Iron Age: We find that mobility among European Holocene farmers was significantly higher than among European hunter-gatherers both pre- and postdating the Last Glacial Maximum. We also infer that this Holocene rise in mobility occurred in at least three distinct stages: the first coinciding with a well known population expansion at the beginning of the Neolithic, and the second and third coinciding with the beginnings of the Bronze and Iron ages respectively. These findings suggest a strong link between technological change and human mobility in Holocene Western Eurasia and demonstrate the utility of this framework for exploring changes in mobility through space and time.

Session: Globalisation and Connectivity

Genotyping of Mycobacterium leprae ancient DNA

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In the past, leprosy sufferers endured social stigma due to the association of this disease with sin. It was not until later that Mycobacterium leprae was discovered to be the infectious agent. In Britain, the earliest palaeopathological evidence for leprosy is from the 4th century AD but prevalence did not peak until the 11th - 14th century before the inexplicable and gradual decline of the disease from the 14th - 16th century. Molecular studies have revealed that leprosy could have originated in East Africa or the Near East. SNP typing separates the pathogen into type one to four that strongly correlate to distinct geographical locations. DNA analysis of leprosy might therefore answer historical questions, particularly the migration patterns of humans in the past, inferred by looking at the spread of the disease. We detected ancient M. leprae DNA in two skeletal remains recovered from a cemetery that belonged to a hospital which housed leprosy patients and one skeleton from an Anglo-Saxon churchyard in the south of England. The ages of the skeletal remains are believed to range from around mid-900 AD to 1700 AD. We have carried out target enrichment via in-solution hybridization capture in an attempt to obtain M. leprae genome sequences. The genotyping of the genome will shed light to the origin of the M. leprae strains that infected these individuals and in turn, provide a better understanding towards the leprosy epidemic in England during the medieval period.

Session: Globalisation and Connectivity

Analysis of parasite DNA for understanding human migration

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Human migration is still a central topic to archaeology, especially when trying to understand smaller or shorter scaled movement. Often animal migration, particularly of domesticates, is seen as a proxy for human trade and migration. This is often complicated by distinguishing between wild and domesticate species, introgression with the wild population, feral roaming and distinguishing between trade and population movement. Human specific gastro-intestinal parasites have limited mobility except for the movement of their hosts and therefore provide an alternative proxy for human migration. Due to the shorter generation time, they also have the potential to fill any gaps in our current knowledge of migration. Despite the fragile nature of adult worms, the eggs are incredibly hard wearing and are regularly found in the archaeological record. The current published data on parasite geographic diversity is currently limited, partially due to the fact that these species are near extinct in Europe and North America. Our research intends to utilise near recent museum parasites to address this gap in the data. With this, we can begin to detect whether there is a 'local' signal unique to those found in Africa, Asia and South America and begin to test whether we can detect migration known from historic sources. Only by completing this work can we begin to use these organisms more widely within an archaeological context.

Genetic analysis of the dwarf shorthorn cattle of Socotra reveals unique ancestry pattern

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The island of Socotra, in the Arabian Sea, was a remote trading post throughout antiquity. Multilingual inscriptions, found in coastal cave sites, testifies to the island's use by Indian, Arabian, Ethiopian, Greek, Palmyran and Kushan traders between the 1st century BC and the 6th century AD. Since the earliest scientific expeditions to the island in 19th century, Socotra has been famed for the uniqueness of its endemic flora. It is also home to a highly unusual breed of humpless, dwarf shorthorn cattle. These cattle are unlike any other found in neighbouring East Africa or the Arabian Peninsula, except in the highlands of Oman. To investigate the ancestry of these dwarf cattle and their implication for ancient trade routes and the spread of domestic cattle we sequenced five modern individuals, from two populations, in Socotra and Oman. Using a reference panel of 793 modern samples, from 69 populations, analysis shows that Socotran and Omani dwarf cattle form a monophyletic clade, unique from any other known cattle breed. Admixture analysis indicates that the breed is mostly European taurine, with a unique pattern of introgression from both African taurine and Asian indicine breeds.

Late Pleistocene/early Holocene maritime interaction in the southeastern islands of the Wallacean Archipelago

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In a recently published study obsidian artefacts from cave sites in the island of Alor southeastern Indonesia were analysed geochemically by portable X-Ray Fluorescence (pXRF). A proportion of the Alor obsidian lithic assemblage (Group 1) was shown to be a strong match with obsidian artefacts found in caves in Timor Leste. Recent excavations at a cave site on the island of Kisar have similarly produced an obsidian lithic assemblage which is a statistical match with Group 1 obsidians in Alor and Timor-Leste. Although the occupation deposits and lithic assemblages date as early as 40,000 cal BP, the Group 1 obsidians occur only after ca. 12,000 cal BP. Currently the geographical location of the obsidian source contributing the artefacts is unknown, however, based on their late appearance and the geology of the islands it is thought that the source location is not on any of the three islands thus investigated, but likely on another island of the Sunda chain. The dating of the obsidian artefacts on these Wallacean islands that were never geographically connected, indicates maritime interaction between the islands began by at least the terminal Pleistocene.

Session: Globalisation and Connectivity

Archaeological Epistemology: A Citation Network Analysis of Lithic Microwear Research

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The introduction of lithic microwear research into the wider academic community by Keeley (1980) was concurrent with the development of the processual paradigm and the adoption of the scientific method. Subsequently, lithic microwear research has benefited from over 35 years of innovation including the introduction of novel methodological and analytical procedures. In the spirit of "critical self-consciousness' (Clarke 1973:7) and objective scientific inquiry, the present study employs a citation network to objectively analyse the development of microwear research. Given developments in technology, as well as the institutional isolation of early studies in the field, the present analysis considers the citation network that stems from Keeley's seminal 1980 volume until May 2015. The 366 papers identified as having cited Keeley (1980) at this point were treated as individual nodes within the citation network. Before analysis, nodes were assigned attributes, including the type of research published (experimental, literature review, assemblage analysis or other focus) and whether they were for, against or neutral to the central tenet of microwear studies; that it is possible from diagnostic marks "to determine, precisely, the functions of individual implements' (Keeley 1980:1). Emergent properties of the network, including closeness, degree and betweenness centrality, were used to test for significant associations between paper attributes. Results indicate the type of paper and its conclusions concerning Keeley's model are significantly related. Moreover centrality measures indicate that a small number of nodes in the network maintain statistically significant influence on the form of the citation network.

Session: Subsistence and Consumption

Zinc isotope compositions of bone and dental enamel as a palaeodietary indicator

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This paper presents the results of a number of studies of zinc isotopes of bone and teeth to explore the possibility of using these measurements as a new palaeodietary indicator. Previous studies of the Zn isotope ratios of modern humans (using blood samples) showed that these measurements did discriminate between omnivores and vegetarians. We present here the results of the measurements of Zn isotope ratios in a number of animal species from two modern ecosystems (African savanna and arctic Canada) where we also observed that Zn discriminated between different trophic levels, with carnivores having lower Zn isotope ratios than herbivores. In addition we have measured the Zn isotope ratios of humans and fauna from two medieval archaeological sites and will discuss the results of these measurements and how they compare to the measurements of C, N and S in bone collagen from the same individuals. Overall, our studies show that Zn isotope ratios in bones and teeth are mainly influenced by trophic level, and to a lesser extent by additional dietary and environmental factors. We also discuss the advantages and limitations of this new tracer especially compared to the main existing isotope palaeodietary methods of C and N isotope measurements of bone collagen.

Session: Subsistence and Consumption

Status-related dietary signal recorded in bone and dentine collagen from the fifth century Gyeongsan Imdang site in Korea

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Here we report the new information on status-related dietary lifestyles using stable isotope analysis of human bones (n=66) from the fifth century Gyeongsan Imdang site in Korea. We extracted isotopic information from dentine and bone collagen, which reflect the early diet and lifetime average diet, respectively. Stable carbon and nitrogen isotope values were measured from master group (high-status individuals), such as local elites as well as individuals from sacrificial burial sites. These two groups present significant differences not only in their accessories but also in their stable isotope results. The carbon stable isotope values of the both master and sacrifice group indicate a largely C3-based diet, in which the possible input of C4 consumption cannot be excluded. The carbon isotope results of individuals from the sacrificial burial sites indicate relatively enriched $\delta^{13}C$ values, which may be attributed to C4 input sources such as millet. The most distinguishing feature of the results is that the male master group shows significant differences in their $\delta^{15}N$ (‰) values in comparison with other groups. The enriched nitrogen stable isotope values imply the consumption of considerable amounts of terrestrial animal protein and possibly marine and freshwater fish in comparison with the diet of low-status individuals. In addition, a maximum 1.9‰ in dentine and bone collagen is reported in the JY-CII-2 $\delta^{15}N$ values, which implies possible dietary changes in their early diet and lifetime average diet.

A Relationship between Diet and Burial Rite at Neolithic Osłonki 1: $\delta^{13}C$ and $\delta^{15}N$ studies

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Diet, and the transition from hunter-gather subsistence practices to the adoption of farming techniques, is a defining characteristic of the Neolithic period in Europe (approx. 7^{th} to 4^{th} millennia BC). To date, the evidence for social status and rank demonstrating a direct correlation with diet via the archive of dietary stable isotope analysis from bone collagen, is largely scarce in prehistoric Europe This research presents stable isotope studies from Osłonki 1 (c.4300 − 4000 cal BC), a Middle Neolithic site located in North-Central Poland.This study investigates a site that was culturally and economically undergoing its secondary phase of Neolithic transformation, specifically to examine the evidence for a link between food access (by $\delta^{13}C$ and $\delta^{15}N$ values of bone collagen), and social status/rank (as evidenced by the stratification of grave goods, e.g. copper vs. non-copper). The consolidation of farming practices, and the increasing presence of food surplus, has the potential to lead to a rise in social inequality and differential access to foods based on social status. The $\delta^{13}C$ and $\delta^{15}N$ collagen values from human individuals and fauna at Osłonki 1 (n=161) show early (statistically significant) evidence for 'status' exerting control over diet during the Middle Neolithic period in Poland. Individuals buried with copper grave goods are more likely to have enriched $\delta^{13}C$ values compared to their non-copper counterparts. No relationship is evident by any other factor (such as sex or age), and no significant variation in $\delta^{15}N$ values was observed.

Session: Subsistence and Consumption

Divergent variation in the spread of the Neolithic: a combined meta-analysis of south-west Asia and Europe

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This study provides a meta-analysis of faunal data from both south-west Asia and Europe during the spread of the Neolithic. The divergence of regional adaptations to both hunting and livestock management are assessed through comparison of taxonomic proportions as well as domesticate survivorship. Biometrical comparisons indicating the development of regional varieties (or 'breeds') is shown developing in tandem with these regional patterns during the course of the (later) Neolithic.

Ancient DNA from charred grain − elusive but tractable

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It is now 25 years since we first reported the presence of ancient DNA in charred wheat grains from the Iron Age site at Danebury. Since then, we and others have shown that DNA preservation in charred wheat and barley is sporadic and that any aDNA that is present is short and chemically degraded. Charred grain is therefore a much less attractive source of aDNA than desiccated plant remains, which often display relatively good DNA preservation. Charred grain is, however, the predominant form of preservation in the archaeobotanical records of Europe and elsewhere, and its utilization has the potential to transform research into early agriculture. To assess the possibility of using next generation sequencing with charred grain, we performed artificial charring experiments with emmer seeds by heating them under conditions that come close to reproducing the appearance of archaeological remains. As expected, the total number of sequence reads obtainable from the samples decreased with increased temperature and charring time. The DNA in the grain accumulated miscoding lesions so that the resulting sequences were no longer identified as wheat by the read assignment software (BLAST, MEGAN). Many reads were misidentified as bacterial or animal, meaning that the identification profiles for the artificially charred grain were similar to profiles we have obtained with archaeological material. Our results suggest that a better understanding of the DNA degradation patterns that occur during charring will enable authentic sequences to be reconstructed from the reads that are obtained from archaeological material.

Tales of the unexpected results: Ritual complexity in a past community revealed by ancient DNA analysis of pre-colonial terracotta items from Northern Ghana

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The pre-colonial 6th − 14th century terracotta forms of Koma Land, Northern Ghana, contain cavities which may have been intended to hold liquids. These have been linked to traditional African libation, but the specific nature of their contents is unclear. We used generic polymerase chain reactions that would amplify DNA from a range of plant and fungal species in order to identify remains of libations applied to fourteen terracotta items. We anticipated difficulties in distinguishing genuine ancient DNA sequences from those resulting from contaminating material, and therefore also carried out a series of control experiments to assess the extent to which the samples had become contaminated with exogenous DNA during burial, excavation and downstream analysis. Taking account of the results of the control experiments, as well as the difficulties in assigning matches between ancient DNA sequences and database entries, we provide evidence for the use of three different types of plant − plantain/banana, pine and grasses − in libations associated with the terracotta items. We also identified DNA from Coniochaeta yeast within the mouth cavity of one figurine, suggesting that this structure was burnt prior to deposition.

The Dietary Impact of the Norman Conquest: A multi-proxy study on Oxford

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The 11th century saw profound socio-political change in England resulting in part from the Norman Conquest. Diet and foodways are sensitive to socio-political changes, reflecting cultural preference, economics and identity. Zooarchaeological and ceramic studies have indicated changes in meat preferences (Sykes 2007) and cooking practices (Jervis et al. 2017), particularly in elite classes. However, previous research has tended to focus on single proxies and uses only indirect evidence. This project uses multi-scalar data to examine the extent to which short and long term dietary change occurred amongst pre- and post- conquest populations. It combines $\delta^{13}C/\delta^{15}N$ isotope analysis of human and animal bones, incremental $\delta^{13}C/\delta^{15}N$ isotope analysis of human dentine, palaeopathological analysis of human remains and organic residue analysis of ceramics. The study focuses on the city of Oxford and investigates changes in diet and health at the individual and community scales, with a particular focus on non-elite classes and health and diet during childhood. Communities are targeted from the century preceding the conquest, the period that straddles the invasion and the century or so after conquest. Although samples are modest, the different dietary proxies provide complex results that are not all in agreement. Overall results suggest relatively limited change in diet and health among lower status communities across the transition. However, faunal isotope results suggests some changes in husbandry regimes, particularly concerning pigs. These results are compared and contrasted with findings from zooarchaeological and ceramic studies on the impact of the Norman conquest.

Meat Market: Organic Residue Analysis of Food Consumption at Corinium

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This paper presents research on diet and subsistence at Roman Cirencester investigated via organic residue analysis (ORA) with a view to investigating cultural exchange and temporal patterns. Besides the work of Cramp (2008; et al. 2012), ORA has not widely been applied to the study of Roman Britain. Corinium was the largest civitas in western Britain, later capital of Britannia Prima, and has been extensively excavated and researched, making it an ideal case study and pilot for my PhD project: a regional study of diet in the Cotswolds. The pilot investigated jars and mortaria spanning 1st - 4th centuries, seeking evidence for consumption patterns. Preliminary results show very high concentrations of lipid in jars, relative both to mortaria and to jars from comparable sites (e.g. Cramp et al. 2012). The lipids were predominantly animal fats: isotope analysis (due for completion by end January 2017) will provide evidence for the origins of the animal fats (ruminant adipose (muscle); ruminant dairy; porcine; marine). Discussion will combine these results with zooarchaeological and human bone isotope data to discuss consumption trends at Corinium.

Cramp, L.J. 2008 Foodways and Identity: Organic Residue Analysis of Mortaria and Other Pottery (University of Bristol PhD Thesis)

Cramp, L.J.E.; Evershed, R.P. and Eckhardt, H. 2012 'Are You What You Grind? A Comparison of Organic Residues from Ceramics at Two Romano-British Sites' in I. Schrüfer-Kolb More Than Just Numbers? The Role of Science in Roman Archaeology: JRA Supplementary Series 91 (Portsmouth): 93-110

Alimentary patterns in the life and death of a Bronze Age settlement. The analysis of organic residues of ceramic vessels in Peñalosa (Jaén, Spain)

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This project seeks to reconstruct the daily activities generated in a Bronze Age settlement in the Southeast region of the Iberian Peninsula: Peñalosa (Jaén). In this archaeological site, as well as in the rest of the Argaric Culture´s sites, the life and death are developed and involved in the same physical space. This reality has motivated a whole chain of questions that we intend to solve through the analyses of organic residues of the ceramic vessels from these two contexts. Did the living individuals consume the same food than the dead? Are there any differences between the organic residues of both? Is it possible to establish the alimentary patterns of these argaric communities? Will the study allow us to draw conclusions about the social differentiation within a community? The comparison between the organic residues of the funerary ceramics and the domestic ones will probably help us to understand the natural relationship between the both worlds. The approach to the behaviors of a society in the past by studying its diet will allow us to understand some key issues that seemed to have no meaning until recent times. In order to achieve these goals, different analytical techniques such as gas chromatography-mass spectrometry (GC-MS) and liquid chromatography-high resolution mass spectrometry (LC-HRMS) have been used. The results of these techniques along with the study of the archaeological record have allowed us to get wider knowledge of the life and death in this Bronze Age culture.

Agriculture and production at the site of Terlinques (SE Iberian Peninsula): $\delta^{13}C$ and $\delta^{15}N$ results in cereal seeds

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From its inception, agriculture has been fundamental to civilization, and societies have improved agricultural production by implementing tools and technological innovations. The study of the evolution of agriculture has been approached from different perspectives applying diverse methodologies. Recently, studies on stable isotopes are have been enabling researchers to delve more deeply into questions such as irrigation and the use of manure. These studies, being applied in different areas of Europe and the Mediterranean Basin, are rendering promising results for the advancement of archaeological knowledge.

Within this framework, we have complemented the results already published for carbon isotope composition ($\delta^{13}C$) at the archaeological site of Terlinques (Villena, SE Iberian Peninsula) analysing the nitrogen isotope composition ($\delta^{15}N$) in the remains of wheat and barley seeds. According to the results of archaeobotanical studies and other archaeological studies in the literature, the values found appear to be consistent with the existence of complex agriculture, which would include the use of different farming techniques. These results are relevant not only for an understanding of agricultural practices in the Western Mediterranean but also for research into the palaeodiet in archaeological settlements.

Approach to the study of burned bones through Infrared Spectroscopy FTIR − ATR

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Bones exposed to fire during food preparation practices are difficult to identify in the archaeological faunal assemblages. Traditional approaches combine macroscopic criteria, like bones tissue's color and surface changes in bones. Thus, it not provide reliable results because of a lack of accuracy in the classification criteria. Physicochemical techniques allow us to observe the changes occurred in the bone's microscopic structure with high resolution and precision. Infrared Spectroscopy FTIR−ATR allow observe, measure and quantity changes occurred in bone tissue due to fire exposition. Contemporary bones of Sus domesticus have been boiled and roasted during different time intervals to characterize at a macroscopic and microscopic level (FTIR-ATR) the changes suffered by bones exposed to heat energy. This allows classification of bones exposed to fire depending on the time and the way they were exposed. Later, this method has been applied to investigate the burned faunal remains of Mesolithic and Neolithic levels of the site Bauma del Serrat del Pont (North − east Iberian Peninsula). Thus, we established 4 categories of thermal alteration according to the changes visible at a macroscopic level and the changes in the bone internal composition. The results obtained from this pilot study evince that through this method it is possible to make an estimation of how the food was prepared in prehistory and to evaluate if the adoption of pottery entrained or no changes in culinary practices. This brings new promising data for the identification and characterization of burned faunal remains in archaeological contexts.

Black as they're painted? Micromorphological appreciations of Orcadian burnt mounds and their associated soils as a proxy for depositional patterns.

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Multiproxy scientific examinations of burnt mound deposits are becoming more common, especially through the avenues of rigorous planning consent and good commercial archaeological practice. However, these studies are often disjointed and deal with material ex situ. Micromorphology, which has been trialled in burnt mound studies across the UK, is now at a stage where it can be used not only to inform upon the biographies of these widespread monuments, but also to recommend an adjustment of current sampling strategies. This study will assess a suite of late-Bronze Age burnt mound sites across Orkney, all of which have been subjected to high-resolution micromorphological analyses. Amongst other findings, these analyses indicate that;

i) Burnt mound material was not deposited consistently, and deposits varied in size, microstructure, nature, and components.

ii) Some burnt mound deposits contain geochemical indicators of midden materials, with characteristics of domestic refuse disposal.

iii) Sub-coastal burnt mounds were regularly inundated by Aeolian sands in periods of increased storminess. This may have led to significant periods of site abandonment, and in one extraordinary case, the construction of a subterranean structure associated with the burnt mound.

Through micromorphology, it may also be possible to tie together existing strands of data on ecology, environment, and direct indicators of human activity. With this in mind, a new sampling strategy is recommended. Ultimately, it is argued that multidisciplinary geoarchaeological and environmental analyses of common site types, like burnt mounds, can lead to new avenues of research and interpretation.

Embracing isotopic variability – or why the mean is not enough

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Isotopic analysis for diet and mobility are now almost ubiquitous in archaeology. The technique is often used with the aim of “reconstructing” an individual’s diet or origin. As such, it is often focussed on the absolute isotopic values. A sample of individuals is analysed so as to get a typical population signal, often characterised by conventional measures of scale, such as the mean and standard deviation. The basis for a “reconstruction” is often more flimsy than people like to admit, with a number of significant unknowns (e.g. diet-to-tissue offsets). Furthermore, from bulk tissue isotopic analysis, we usually have only two parameters (e.g. collagen carbon and nitrogen isotopic values for dietary analysis, or enamel strontium and oxygen isotopic values for mobility) from which to model the full complexity of human behaviour. Here, I ask why researchers do not spend more time looking at relative values as a way to characterise the sample analysed – such as the spread within a sample, and the variability with different parameters. I draw on the concept of the isotopic niche as proposed in isotopic ecology as a way to explore ideas of variability of past human populations.

Spatio-temporal variation of tooth enamel phosphate oxygen isotopes in Britain

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It is widely established that movements and relocation of past individuals and populations can be investigated by means of isotope measurements of soft and hard tissues in archaeological remains. Oxygen isotopes ($^{18}O/^{16}O$) from skeletal remains of buried individuals have proved particularly useful for this purpose, because the $^{18}O/^{16}O$ ratios in mammal tissues are closely related to the $^{18}O/^{16}O$ ratios of ingested food and drink, which in turn are ultimately related to the local environment. A common practice in these studies is to convert measured skeletal isotopes to local drinking water values by means of empirical correlations - a process which is known to be problematic[1,2]. Geostatistical analysis of isotopic ratios from Beaker burials has characterised the spatial variation of tooth enamel oxygen isotopes during the Chalcolithic and Early Bronze Age, avoiding the need to convert the phosphate values to water values[3]. The approach taken with the Beaker burials is extended in this paper to characterise temporal patterns in the spatial variation of tooth enamel oxygen isotopes in Britain from later prehistory to the Post Mediaeval period.

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3. Pellegrini M, Pouncett J, Jay M, Parker Pearson M, Richards M. 2016. Tooth enamel oxygen "isoscapes" show a high degree of human mobility in Prehistoric Britain. SciRep 6:34986.

(ex)change and decay: $\delta^{18}O$ composition of archaeological collagen

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Archaeological studies of animal and human mobility regularly employ the analysis of $\delta^{18}O$ of tooth enamel carbonate or phosphate, which is derived from juvenile diet/drinking water $\delta^{18}O$ composition, and is therefore linked to location of origin. Only a few groups have studied $\delta^{18}O$ in the principal protein of archaeological interest, bone collagen, which could potentially yield similar information about a range of periods of adulthood, depending on which skeletal element is analysed. Recent studies have shown that preparatory laboratory workup for enamel has a range of crystallisation and isotopic effects, which may obscure the original endogenous signal from the tissue. Collagen workup is chemically very different, but these processes (demineralisation and optional gelatinisation in aqueous solution, then freeze drying) may also change endogenous protein $\delta^{18}O$ because proteins are known to exchange carboxylic O with solvent water at low pH. We describe the results of an experiment on four bone collagen materials with a range of $\delta^{18}O$ values to examine the effects of: (1) the workup methodology (EDTA or HCl); (2) the isotopic composition of workup solutions; and (3) the isotopic composition of atmospheric moisture, on resultant collagen $\delta^{18}O$ values. We show that O exchange does occur in demineralisation solution as well as during the gelatinisation step. We demonstrate that collagen exchanges O with atmospheric moisture. We discuss how O exchange may be affected by taphonomic degradation of collagen molecules, and discuss our $\delta^{18}O$ data in the light of MALDI-TOF MS characterisation of protein damage.

Session: Populations and Lifeways

Tracking Humans: A bio-archaeological approach to the history of pre-colonial populations in the Dogon Country (Mali)

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Our research investigates the dynamics of what life was like during pre-colonial times for pre-Dogon and early Dogon people from the Bandiagara Escarpment in Mali, by using AMS radiocarbon dating, stable isotope analyses, and dental anthropological studies of human remains. We test the hypothesis of a non-continuous pattern of settlement in the Dogon country as suggested by the Toloy-Tellem-Dogon chronocultural sequence, which consists of three phases: a "Toloy" occupation (3^{rd} – 2^{nd} c. BC), a "Tellem" occupation (11^{th} to 15^{th} c. AD) and a Dogon occupation post 15th c. AD. New AMS ^{14}C dates (n = 84) from the human remains demonstrate a continuous chronological sequence for the burials. There is a wide distribution in carbon (-14.2 to -6.0‰) and nitrogen (6.0 to 14.8‰) isotope ratios. Carbon isotope ratios indicate both a change in diet through time and different diets between pre-Dogon and Dogon people, which could be explained by a change in climate leading to a heavier reliance on C4 grains, e.g. millet. Nitrogen ratios suggest either a climate effect (drier and hotter climate around 16^{th} c. AD), or a higher protein intake by the early Dogon. Frequencies of dental diseases are very high, but also show variation through different burial sites. The differences in dental diseases are likely due to differential food preparation or types of foods eaten. In conclusion, our preliminary interpretations suggest that diets were varied through time, space, and intra-communally.

Isotopic investigations of diet, weaning and 'stress' during the agricultural transition of the northern Atacama Desert

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Although the Atacama Desert of South America is one of the driest places on Earth, the snowmelt fed river valleys of the Northern Atacama became important agricultural centres under the Inka Empire. We used isotopic analysis of human bone collagen and incremental sampling of dentine to investigate diet and weaning during the adoption of agriculture in this region. Our data exhibit extraordinary diversity with human isotope values ranging from 8.3 to 29.5‰ in $\delta^{15}N$ and from -19.6 to -9.1 ‰ in $\delta^{13}C$. The results highlight the dietary diversity of adults, and the continued importance of marine resources, throughout both the pre-agricultural (prior to 1700BC) and agricultural (1700BC−1600AD) periods. Childhood diets show a variety of isotope trajectories within each period but some trajectories are repeated between periods. Some individuals have a classic isotopic weaning profile, and others have profiles similar to those which have been considered indicative of physiological 'stress'. However, there are multiple additional patterns. Interpretation is complicated by the presence of C3, C4, and marine resources in an area of high aridity and, in the agricultural period, the possible use of guano as a fertilizer. However, despite cultural changes and the introduction of new crops, we conclude that environmental constraints remain important in adults' subsistence choices. The repetition of nearly identical isotopic profiles in the infancies of individuals from different periods demonstrates that this was also true of childhood diets, but other factors such as physiological stressors are also apparent in some incremental profiles.

Reconstructing and Quantifying the Ohalo II Diet from archaeological and archaeobotanical data

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Although there have been many attempts to reconstruct the composition of Palaeolithic diets, no estimates of whole diet nutrient compositions are available. The Upper Palaeolithic site of Ohalo II in Israel, dating to 23,000 ky B.P., provides exceptional preservation of floral, faunal, avian and aquatic assemblages. Using these assemblages, palaeo-climate-based approximations of the proportions of hunted, gathered and fished resources to the total human diet, and the USDA National Nutrient Database for Standard Reference, Release 28 (http://www.ars.usda.gov/ba/bhnrc/ndl) it was possible to generate quantitative estimates of the macro- and major micronutrient composition of the Ohalo II diet. These estimates were then compared with the nutrient compositions of modern hunter gatherer diets to assess to extent to which modern hunter gatherer data can be used as a proxy for ancient diets. Using a range geographically and ecologically diverse hunter gatherer diets including those from circum-Arctic, savannah, costal and rain forest environments, we found that the nutrient profiles of these diets cluster together with the Ohalo II diet, to the exclusion of modern diets. The Ohalo II diet reconstruction is central to validating the method of using modern hunter gatherer diets as proxies for ancestral diets, while also demonstrating that it is possible to quantify a Palaeolithic diet from archaeological and archaeobotanical data.

Session: Populations and Lifeways

Molecular Archaeoparasitology as a novel archaeological tool

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Parasites are common in many archaeological contexts. Historically, parasitological research in archaeological contexts has relied upon time-consuming microscopic diagnostic methodologies that are constrained by the sensitivity and specificity of morphological diagnosis. We have developed a suite of molecular tools that offer a new insight into these studies, allowing reliable, highly specific diagnosis and providing additional information on the genetic diversity of parasites over space and time. The application of these methods will be discussed in the context of the use of parasites to interrogate issues related to hygiene, diet and socio-economic characters. These new approaches will be widely applicable, contributing a novel perspective that can be integrated within a variety of historical and archaeological studies.

Session: Populations and Lifeways

The Hole Story: Ancient DNA, stable isotope and radiocarbon analysis of human remains from the 'Mesolithic' cemetery at Aveline's Hole

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Aveline's Hole Cave in the Mendip Hills, Somerset, England, which was originally excavated in 1860, is renowned as the earliest known cemetery in Britain. Up to 50 individuals were interred in the cave, although remains of only around 21 individuals have survived. Dozens of radiocarbon dates obtained from this assemblage are tightly clustered in the mid-late 9th Millennium BC, the Early Mesolithic. These tight dates suggest that whole bodies were interred over a relatively short period, after which the cave was sealed, perhaps deliberately. Here we present Next Generation Sequencing whole genome data, as well as further stable isotope and radiocarbon dating results from the Aveline's Hole human assemblage. Our results suggest that the assemblage includes human remains which date to the early 4th Millennium BC, show dietary signals more consistent with a farming than a hunter-gathering lifestyle and which have genetic affinities with European Middle Neolithic populations ultimately deriving from Anatolia. These results not only inform on the nature of the British Mesolithic-Neolithic transition, but also overturn the conventional archaeological narrative of this unique and important site.

MitoBench: An interactive visual workbench for population genetics on mitochondrial DNA

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Despite the availability of modern next generation sequencing technologies and therefore nuclear human genomes, the sequencing and analysis of mitochondrial DNA (mtDNA) is still common. Especially in the research field of ancient DNA and the context of population genetics, mtDNA is often the only proxy available to study extinct populations and their relationship with modern populations. As a consequence, many population genetic studies rely on the analysis of mtDNA. A plethora of methods for the analysis of mtDNA exist, that adress questions in population genetics, phylogeny and others. However, these tools typically rely on different file formats and often require manual interaction with the data for downstream analysis. Ultimately, these steps can be cumbersome, especially for non-bioinformaticians, resulting in an increased risk of errors during the analysis. To tackle these issues, we present MitoBench, a workbench to interactively analyze and visualize mitochondrial genomes with a focus on population genetics. The graphical user interface is kept simple, to accomodate even users without further prior knowledge on computational methods. Furthermore, it shows additional information such as metadata and statistics. Currently, MitoBench offers automatic file conversion tools to connect the workbench with existing analysis methods such as BEAST, Arlequin and others. In future, we will also link MitoBench to a large database for mitochondrial reference data. Our ultimate aim is to provide a central reference database of population genetics studies on mitochondrial data that can be easily accessed via the workbench.

Session: Populations and Lifeways

The Canopic Jar Project: an interdisciplinary study of ancient Egyptian soft tissue remains

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The Canopic Jar Project is examining a larger series of ancient Egyptian human soft tissues samples in a truly interdisciplinary research setting (medical, genetic, chemical and Egyptological) from canopic jars and bundles in European and American museum collections. The project is macroscopically, radiographically, chemically and genetically studying canopics to investigate the contents. All canopics are studied with X-ray and, where possible, by CT-scan, in order to investigate the contents prior to sampling. Samples which are extracted from the canopics undergo; 1) histological examination − to identify the organ interred, assess the preservation of the sample and identify any pathological tissue, 2) molecular examination − to assess DNA preservation, identify the individual, examine the genetic relationship between pathogens and hosts, assess co-infection and investigate ancient microbiomes, and 3) chemical analysis − to identify the components used in the embalming process. This presentation will outline the initial results of the study, drawing together the genetic, radiological, chemical and histological analysis. Including the positive histological identification of intestinal tissue and genetic data from both conventional and HTS techniques. Funded by SNSF (no. 162803) and the Maxi Foundation

Session: Populations and Lifeways

Analytical techniques for the investigation of Roman funerary practices and population reconstruction. A case study from Pompeii

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Since 2015 a research project led by the British School at Rome, Colegio de Doctores y Licenciados de Valencia and Museo de Prehistoria de Valencia has been studying the burials and funerary practices at the necropolis of Porta Nola, Pompeii. A series of cremations from across the full spectra of the population have been examined, revealing pathologies and diet of the people of Pompeii. Alongside this analysis, the project has worked with the Soprintendenza Pompeii on the study of the plaster casts made since the early 20th century of the victims caught fleeing the volcanic eruption of Vesuvius in AD 79. This paper will discuss the techniques used to examine the individuals, including photogrammetry, laser scanning, x-rays and CAT scans which have been combined to shed new light on the daily activities of the population, as well as their diet and physical appearance.

Secrets of the Anglo-Saxon goldsmith: Scientific results from the analysis of the Staffordshire Hoard gold

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[1] Independent

The discovery of the Staffordshire Hoard in 2009 led to the development of a cross-disciplinary programme to conserve, research and disseminate the find. The Hoard consists of the largest assemblage of Anglo-Saxon gold and silver objects, most of which is battle regalia. Many different raw materials were brought together to create the objects in the hoard, including; precious metals, garnets, glass, organics and other inlays. Most of the material belongs to the sixth to seventh centuries and much is richly decorated with intricate interlace patterns carried out using a variety of techniques including cloisonné garnet and filigree. As part of the wider research project studying the Staffordshire Hoard a ground breaking study of the gold was carried out. The work has revealed more details about workshop practice and from this it is possible to outline some of the decisions made by the goldsmiths in the Anglo-Saxon period to enhance the appearance of the objects.

Metals and networks on the steppes crossroads: Bronze Age metallurgy in Semirechye, Kazakhstan

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The core of the emerging power of the 3rd and the 2nd millennium BC Eurasian Steppe societies is deeply intertwined with the knowledge of metalmaking, and resources of copper and tin that were controlled by them. Extensive studies of typology, composition and distribution of metal implements from the Eurasian Steppe laid the building blocks of narratives explaining cultural dynamics of the Bronze Age societies in this region. The widely accepted model of metallurgical provinces, established by E. N. Chernykh, differentiates multiple core areas of metal production across the region. Nevertheless, little has been done to address the organization of metal production outside the core 'grid', and adoption strategies of pastoralist nomads. Here we present archaeometallurgical analysis of artefacts and production evidence from Begash and Dali, two 2nd mill BC Bronze Age settlements located in Semirechye, southeast Kazakhstan. These high-altitude campsites are set on the crossroads of important trading routes, yet distant from currently known ore sources and large-scale metal production centres. The analyses reveal metal production evidence in Semirechye, a continuous use of copper and tin bronze artefacts, as well as sourcing of several ore deposits along the Inner Asian Mountain Corridor. Metallurgical innovations are interpreted in the context of increased specialisation in pastoral herding and political complexity in the 2nd mill BC Semirechye, and beyond. Complex networks analyses provide a glimpse into the interconnectedness of pastoralist societies on a broader scale, and encapsulate the dynamics of metal production and consumption on the Steppe Bronze Age trading crossroads.

New insights into the technology and provenance of British Late Bronze Age metalwork: the Boughton Malherbe hoard (Kent)

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The Boughton Malherbe hoard (Kent) was discovered by metal detectorists in 2011 and purchased by Maidstone Museum and Bentlif Art Gallery. Containing 344 pieces from approximately 340 objects and weighing 64.2kg, this is one of the largest Late Bronze Age hoards in Britain and the largest among those belonging to the Carp's Tongue complex.

This paper presents and discusses analytical work carried out on this hoard, consisting of 60 compositional analyses using handheld-XRF and a further 7 lead isotope analyses of copper ingots. A range of objects were analysed including tools, weapons, plate objects, mould fragments and casting waste. We consider our results in light of a wider analytical programme which includes other Late Bronze Age hoards from the Atlantic area. Previous analytical work on the Atlantic Late Bronze Age metallurgy is also taken into account in our discussion.

Developing Archaeomagnetic Dating in the Scottish Neolithic: Geomagnetic variation in Orkney, Scotland

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Archaeomagnetic studies have been employed as a dating technique in the British Isles for the last 50 years, using the record of the ancient geomagnetic field recorded by fired archaeological materials. Archaeomagnetic dating can be a powerful chronological tool that dates the last anthropogenic use of an archaeological feature. However, in order to provide a date of last firing, variations in the past geomagnetic field must be established. The impediment for archaeomagnetic dating of the UK Neolithic has been the lack of data of known date defining the past geomagnetic field. This paper will address this lacuna and present crucial developments in elucidating geomagnetic field variation in Orkney. Extensive sampling of fired material from the Neolithic sites at the Ness of Brodgar, Smerquoy and The Links of Noltland have enabled a compilation of 32 mean stable magnetic directions from over 700 samples. In particular, the internationally significant excavations at the Ness of Brodgar have yielded a large number of stone-built structures which contain formal hearth settings and other burnt deposits. This paper will specifically demonstrate the benefits from analysing multi-layered hearths containing well-stratified burnt deposits. By combining the radiocarbon dating evidence, the artefactual information and the archaeomagnetic study, this research shows the recent developments in defining the geomagnetic field variation. The outcomes of this research will allow archaeomagnetic dating of other archaeological sites in the Scottish Neolithic and will be a valuable contribution to wider study of the past geomagnetic field.

Session: Procurement and Production

The raw material as an added value of ceramics?

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This paper aims to question the role of the raw material used to shape ceramics in their diffusion. Have the physical and mechanical proprieties of the clay and of the mineral inclusions allowed diffusion at greater distances of ceramics? To approach this question, we will present several examples of petrographic and geochemical studies HH-XRF and pLA-ICP-MS of potteries. The geographical and geological contexts will be the Armorican massif, in western France, a crystalline massif mainly made with metamorphic and magmatic rocks. These instances will be chosen from two periods: the late Neolithic (3800 - 2800 B.C.) and the late Iron Age (450-250 B.C.). Indeed, we observed during our research the preferential diffusion of two types of pastes coming from the alterations of rocks whose outcrops are rare on the Armorican massif. The first one is an alteration clay of magnesian schists (a metamorphic rock) characterised by plenty of talc, and the second one is an alteration clay of a gabbro (a magmatic rocks) defined by a high number of green and colourless amphibole inclusions. The qualities of those pastes are a good diffusion of the heat, a better resistance to the thermal shocks and a higher impermeability. In addition, those potteries have been discovered on specific sites with specialised activities (late Neolithic) or in ritual and deposit contexts (late Iron Age). The paper examines the raw material of ceramics as one of the criteria that make certain potteries a wanted property.

What's black, sticky, and red all over? An analysis of hafting adhesives in South Africa's Later Stone Age

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The characterisation of hafting adhesives, the glue of composite tools, by chemical analysis and microscopy provides a means by which we may evaluate these plastic components of technologies; reliable systems that have allowed members of our species to exist in dynamic environments and exploit a variety of resources. In South Africa, the well-preserved assemblages of the Later Stone Age (LSA) present a unique opportunity to evaluate the raw material sources of these adhesives. This presentation highlights the findings of the first multi-site study of hafting adhesives from the Holocene assemblages housed at the Albany Museum (Grahamstown, South Africa) and the Iziko Museums (Cape Town, South Africa). Optical light microscopy (OLM), scanning electron microscopy/ energy dispersive X-ray spectroscopy (SEM/EDS), Fourier transform infrared spectroscopy (FTIR), and gas chromatography coupled mass spectrometry (GC-MS) are used in tandem to identify the botanical sources of adhesives and characterise any organic or inorganic additives. Based on the results obtained from this multi-analytical approach, I will attempt to identify consistencies or changes in adhesive recipes, and highlight how this contributes to both our understanding of these plastic technologies and the narrative of adhesive manufacture in southern Africa.

Towards the elucidation of the presence of long-chain fatty acids in archaeological lipid extracts from pottery

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The molecular and stable isotope analysis of lipid residues extracted from archaeological potsherds allows the organisms exploited by humans to be identified. Fatty acids (FAs) are the most commonly detected components of extracts from archaeological potsherds, with the palmitic and stearic FAs predominating. Long-chain FAs (LCFAs) up to C24:0 are sometimes observed in the suite of lipids extracted from archaeological ceramics. The identification of LCFAs is of particular interest as it offers potential for extending interpretations of the origins of lipids in archaeological potsherds in relation to animal and plant exploitation in Prehistory. The detection of palmitic and stearic FAs, with the latter dominating the extracts, points to a major contribution from animal fat in the vessels, arising from animal product processing. While it is tempting to interpret the LCFAs as originating from plant lipids, e.g. epicuticular waxes, however, the high abundance of the stearic FA, and the absence of other plant wax biomarkers, including alkanes, alcohols, ketones and/or triterpenoids, does not support this interpretation. Here we report the results of investigations into the origin of the LCFAs in archaeological potsherd lipid extracts by: (i) carrying out isotopic analyses on FAs, including LCFAs, extracted from archaeological potsherds, (ii) studying modern animal fats using GC/q-TOF MS, and (iii) modelling anticipated changes in FA profiles resulting from diagenesis. We conclude that the LCFAs extracted from archaeological ceramics likely originate directly from animal fats, incorporated into the fats via routing from the ruminant animal's plant diet.

Molecular composition, characteristics, intended use and degradation of contrasting large-scale organic residues.

B. Stern[1]

[1] University of Bradford

Organic residue analysis is usually associated with absorbed lipids in ceramic vessels and occasionally with organic material present as visible coatings on the surface of sherds. This paper will discuss rarer cases of large-scale organic masses. Amongst the samples examined are organic materials from a Late Roman-Coptic storage jar found in the Eastern Sahara, and samples from the National Museums Liverpool mummies and sarcophagi. The first sample was rubbery with a wrinkled surface, orange/brown, and only partially soluble in solvent. The second set of samples include some which are hard with a glossy surface, black and completely solvent soluble. On visible inspection the initial expectations were that these samples would be resinous/bitumen. However, GC-MS analysis revealed a range of fatty acids in both sets of samples, with the addition of beeswax and possibly other material in the National Museums Liverpool samples. The detailed molecular composition of these samples will be discussed alongside the different characteristics of these 'polymerised' oil/fats. The original intentions of their production (colour, solid/liquid etc.), use (in narrow necked vessels, careful application around images in contrast to uneven/dripping application over other areas and images) and processes of degradation will be explored and supported with experimental work on modern drying-, semi- and non-drying oils.

The Application of a Completely Non-destructive High-Resolution X-ray Diffraction Technique in Cultural Heritage Science

G. Hansford[1]; S.M.R. Turner[1]; P. Degryse[2]; A. Shortland[3]

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A novel X-ray diffraction (XRD) technique which provides high-quality phase and microstructural analyses of archaeological objects completely non-destructively and with no sample preparation at all is presented. The technique has previously been described in a low-resolution configuration [1-3], suitable for implementation in a handheld instrument format, but more recently a study was conducted at the Diamond Light Source synchrotron in a high-resolution configuration. This work was mainly focussed on the development of the technique using geological samples, but analysis of a small number of archaeological artefacts was attempted, including a sixth-century glass tessera from Sagalassos, Turkey, and a copper Roman coin. It is expected that this XRD method will have wide applicability within cultural heritage science, suitable for the analysis of pottery (including pigments and glazes), jewellery, any objects made from stone or rock, and artworks such as paintings and sculptures. The results of the study as a whole will be presented along with a discussion of the application of this technique in archaeometry.

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The *Ancestors of Christ* from Canterbury Cathedral: An investigation of medieval stained glass window production by handheld pXRF

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[1] UCL Institute of Archaeology, [2] The Cathdral Studios, Canterbury

A stained glass window represents a complex chaîne opératoire, from glassmaking and acquisition, through cutting and painting the glass and constructing the window, and later re-use and conservation. Analytical techniques can be used to better understand the life history of medieval windows, but the situation of most windows requires the application of *in situ* methods such as pXRF, which can be problematic in practice.

Deterioration and surface alteration is one such problem, and will be discussed in this paper. Another is the interference of the lead cames that hold the glass pieces together, which can prevent the spectrometer touching the glass. The resultant inability to control the distance between sample and detector severely limits the pieces that may be analysed with acceptable precision and accuracy. We have developed an attachment for the spectrometer that maintains a constant distance between the glass surface and X-ray detector, bypassing the lead cames to allow analysis of nearly any glass piece in a panel. Tests confirm that the resultant data is affected by reduced intensity, but calibrations can be applied to quantify the data.

Canterbury Cathedral's *Ancestors of Christ* series, originally comprising over 80 stained glass panels, has a complex life history, with at least three probably production campaigns extending over 50 years in the late 12th century; the panels were later moved to and adapted for large windows elsewhere in the Cathedral. Three panels from the series were analysed using handheld pXRF equipped with the fixed-distance spacer. This paper will discuss the life history of the glass, including changes to the glass sources and production over the different campaigns of glazing and conservation. The possible earlier date of one panel will also be discussed.

Long-distance trade in the Iron Age: Glass beads from Novo Mesto, Slovenia

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Excavations at the Kapiteljska Njiva and Mestne Njive sites in Novo Mesto, Slovenia, yielded one of the most abundant assemblages of prehistoric glass beads in Europe. Analysis of 49 Iron Age (eight- to first-century BCE) glass beads and one glass bracelet has been undertaken using Laser Ablation Inductively Coupled Mass Spectrometry (LA-ICP-MS). Many beads are multi-coloured, giving a total of 95 analysed glasses.

Several compositional glass groups of different origins have been discerned. A group of cobalt-coloured glasses, high in Al2O3 and MgO, closely resembles glass retrieved from a number of sites in France and from Nimrud, Mesopotamia. A group of low-alumina appear to be based on Egyptian natron, suggesting SE Mediterranean as a likely source. The majority of glasses analysed have 1.3-2.6wt% alumina, and appear to correspond to Levantine glass production. Finally, a small number of plant ash glasses are of uncertain origin at the time of writing.

The results indicate the existence of long-distance EIA trade routes and a diverse range of natron glass sources at a very early stage in the development of this glass type. The existence of local glass workshops remains uncertain. The high alumina and low lime/high alumina glass suggest imported glass, but does not rule out the possibility that the beads themselves were fabricated locally. Further investigations into the low alumina base glass type might provide evidence of local primary glass production, but its relatively low abundance suggests that this is unlikely.

Painting Amara West: paint technology in ancient Sudan

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[1] UCL Institute of Archaeology

The ancient Egyptian colour palette has been investigated extensively, but nearly always from royal, elite and funerary sources, typically based on objects in museums. The British Museum excavation of the ancient Egyptian town of Amara West in northern Sudan has enabled an examination of the use of colour by a very different section of the population, enhanced by the ability to export samples for laboratory analysis. Sampling paint from modest houses and coffins has revealed the use of pigments and binders by the non-elite. Materials analysis of the paints, plus evidence from a dump of materials relating to colour production (raw pigment, palettes, grinding stones), sheds light on the chain of actions that people enacted to create and use the paint. In addition to a traditional materials analysis, I performed an experiential study of similar materials to investigate the potential of the sensory importance of the materials, beyond the obvious visual colour. My scientific investigation of the paints from palettes and walls in the town uses polarised light microscopy, infrared spectroscopy, X-ray fluorescence, scanning electron microscopy, and visible-induced luminescence to identify inorganic pigments; and gas chromatography mass spectrometry to identify organic binders. Bitumen was found in some palettes, and in association with coffins, including large samples, which allowed the provenance of the bitumen to be investigated.

Session: Animal-Human Interactions

A decade of Zooarchaeology by Mass Spectrometry (ZooMS)

M. Buckley[1]

[1] University of Manchester

As it has been ten years since I first introduced ZooMS, short for 'Zooarchaeology by Mass Spectrometry', to the archaeological science community (UKAS 2007; Cambridge) as a means of species identification of animal bone fragments, it seems appropriate to evaluate its progress. Initially going through a rapid methodological development through approaches of bone collagen peptide fractionation and isolation, the method most commonly associated with ZooMS is the simplest form of collagen fingerprinting. However, even this has gone through methodological developments relating to increasing the high-throughput productivity, improving the compatibility with other methods commonly used in bioarchaeology (e.g. radiocarbon dating, stable isotope analyses and ancient DNA sequencing) and even reducing the destructive nature of the sampling process. The concept of ZooMS has also been widened to a range of other archaeological tissues and, due in part to decreasing costs and/or increasing accessibility to high-end proteomics instrumentation, more sophisticated LC-tandem mass spectrometric techniques. This presentation will evaluate all of the above in combination with an improved understanding of the taxonomic resolution and other information that can be obtained, concluding with several recent examples relating to human subsistence in prehistory.

Using the Other 90%: Identification of Fish Bones and Scales using ZooMS

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Identification of archaeological fish bone is frequently difficult and some studies suggest that upwards of 90% of fish bones that have been recovered languish in boxes without a species (and in most of those cases without even family) identification. This lack of identification not only compounds the already difficult job of understanding archaeological fish resource use, but also makes it extremely difficult to interpret patterns in aquatic ecosystems that might be useful to better understand how fish populations respond to changing anthropogenic and environmental pressures. Protein identification using ZooMS has the potential to identify bones to species more easily than DNA when morphological approaches fail, but fish ZooMS has proven quite difficult due to the array of fish species. I will discuss improvements in ZooMS for fish and how it can be used to identify even closely related fish species.

Session: Animal-Human Interactions

A Compound Specific Isotope Approach to Reconstructing Aboriginal Palaeodiet in Northeastern Canada

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The hunter-gatherer populations who inhabited the North Atlantic coast of Canada were generally marine-adapted, but cultural differences in diet and mobility patterns are presumed on the basis of archaeological data. These lines of evidence, further supported by bulk $\delta^{13}C$ and $\delta^{15}N$ values of human bone collagen, indicate that the Dorset Palaeoeskimo (2000-900 BP) were specialized marine mammal hunters, while the economy of the Beothuk Amerindians (2000-150 BP) had a broad marine-terrestrial focus. Regarding the diets of the earliest inhabitants, the Maritime Archaic (8000-3200 BP), considerably less is known. Variable bulk $\delta^{13}C$ and $\delta^{15}N$ collagen values have been measured in 104 individuals from the Maritime Archaic cemetery site of Port au Choix-3 (4200 BP), in Newfoundland, but as few faunal bone assemblages from this period exist, the relationship of isotopic variability to geographic differences in diet, or to social determinants, is unclear. We present the results of compound specific carbon and nitrogen isotope analysis of collagen amino acids from a selection of human and animal bone samples recovered from Newfoundland and Labrador and ranging in age from 7500-150 BP. Collagen amino acids were derivatized to their N-Acetyl-2-Propanol esters and their $\delta^{13}C$ and $\delta^{15}N$ values measured via GC/C/IRMS. We constrain the effects of different geographic baselines by comparing the $\delta^{13}C$ and $\delta^{15}N$ values of essential and non-essential amino acids with trophic level indices in order to present a refined, diachronic reconstruction of aboriginal subsistence practices in Northeastern Canada.

Human-horse interactions in the Paleolithic: Stories in the round

E. Assaf[1]

[1] Tel-Aviv University

The central role of horses in Paleoithic diet and culture is well reflected by the presence of horse skeletal remains at Paleolithic sites, and by multiple representations of horses in Upper Palaeolithic cave depictions and tools made of horses bones. It is rather evident that early humans saw horses both as an essential element in their adaptation, as well as non-human-persons and habitat companions. I will suggest that the roots of human-horse interactions go back to the Lower Palaeolithic period.The notable presence of horses in the faunal record of many Palaeolithic sites demonstrates their significance in human diet, since horsemeat and marrow have unique positive nutritional characteristics, significantly superior to that of most ungulates. Findings from Qesem Cave, Israel, (420-200 ka bp) support this notion; implying horses were routinely consumed on-site. An unusual number of horses' teeth were found in a specific location, along with specific tools − spheroids (stone balls). Battering and breakage patterns observed on these items might indicate their function as percussion tools used for breaking bones and extracting marrow. Data from other Levantine and African Paleolithic sites point to a similar association between spheroids and horses. The evidence discussed is leading towards a preliminary hypothesis of a possible link between the in-tandem disappearances of large horses and spheroids from the Levantine landscape. The findings demonstrate the central part of horses in early humans adaptation, and the role of spheroids might have played in the extraction of the valuable horse marrow.

Session: Animal-Human Interactions

New approaches to the origins of reindeer husbandry using integrated geoarchaeological and lipid biomarker analyses

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The shift from hunting to the domestication and herding of reindeer (Rangifer tarandus) was one of the most important transitions in human-animal relations in northern Eurasia. While the precise location and date of this transition is hotly contested, the methods used to illuminate the presence of domesticated reindeer in the archaeological record have not advanced significantly in recent years. This paper presents the first results of the interdisciplinary project 'Human-Animal Relations in Northern Eurasia', which aims to develop new scientific approaches for the identification of ancient reindeer-herder sites by focussing on signatures in soils that can be linked to reindeer aggregations/corralling. We present recent research on the Iamal peninsula, northwest Siberia, a region often cited as one of the 'hearths' of reindeer husbandry. Excavations by the Archaeology and Ethnology Division, Scientific Centre for the Study of the Arctic, Salekhard, at a site known as Iarte VI, revealed a deep, well-stratified sequence dating to the 11th - 12th century AD containing the remains of dwellings, thousands of reindeer bones, and well-preserved artefacts associated with reindeer husbandry based on ethnographic parallels to modern Nenets' material culture. Soil mapping adjacent to the site revealed multiple sequences of soils separated by aeolian sands, which were sampled for radiocarbon dating and geochemical, micromorphological, and lipid biomarker analyses. This interdisciplinary approach, coupled with methodological research on modern reference samples of herbivore dung, is providing the first direct evidence for the presence of congregated reindeer herds in close association with human habitation.

Session: Animal-Human Interactions

Insights into dairying and diet in ancient Mongolia through the proteomic analysis of dental calculus

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The introduction of domesticated animal milk into the human diet marked a pivotal step in the opening of marginal environments for nomadic pastoralism through newly available 'secondary' products. However, the first documented appearance of dairy in Mongolia occurred later than in Western Eurasia. This talk will introduce an ongoing collaborative project, which includes the proteomic and microscopic study of ancient dental calculus, paleopathological skeletal assessments, as well as genetic, genomic and isotopic analyses to determine when milk entered the eastern steppes, and what effects its incorporation had on ancient Mongolian populations. Through a paleopathological analysis of 245 crania from sites excavated across Mongolia we found significant differences in skeletal indicators of nutritional deficiencies between those from the Neolithic/Bronze Age and later Iron Age/Turkic/Mongolian populations. These differences may indicate a distinct change in diet as people transitioned from hunter-gatherer/sedentary lifeways into more the meat and dairy-based diets of nomadic pastoralists, and may indicate a difference in biologically or culturally available resources between the two periods. To test the possible influence of pastoralism and dairy use in these individuals the presence of milk proteins will be determined by tandem mass spectrometry (LC-MS/MS), which will enable the species-specific identification of milk products directly from individuals. When all aspects of the project are completed, we will be able to expand our understanding of the effects the change in subsistence strategies had on Mongolian diets.

Session: Animal-Human Interactions

Contrasting the influence of factors shaping the spread of early farming using an adapted cultural dissemination model

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The development of early farming is arguably a fundamental technological revolution. In the European case, both plant and animal domesticates were introduced from an external centre of domestication located in the Near East, so that we are dealing with a process of technological diffusion and adaptation. As evidenced by an impressive quantity of archaeological data, the spread of agriculture and stock-breeding across Europe is a long and uneven spatio-temporal process which lasted over three thousand years and, without much surprise, was paralleled by a variety of archaeological assemblages.

The dispersal process that occurred at the onset of the Neolithic in Europe has a role in shaping the distribution technology and culture throughout the following millennia, which has yet to be fully understood. As part of an ongoing ERC-funded project (EUROFARM; PI: Dr. M. Vander Linden), we are developing our understanding of that process through theory and the application of an agent based model.

The cultural dissemination model devised by Axelrod (1997) offers and extremely simple analogue to the archaeological assemblages through which we observe the past, and with minor additions we adapt it to the conditions of the early-mid Neolithic, where at first the migrant front, and later adaptation to local environment, may be the driving forces that shape the evidence that we observe.

Ancient Whole Mitochondrial Genomes and Insights into the Prehistory of Goats

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The domestication of goats is thought to have occurred in the Near East approximately 10,000 years ago. As one of the earliest domesticated animals, elucidating the patterns, pace and major events of the process is of great interest. However, such analyses using genomic data from modern goats are hampered by 10,000 years of human-mediated movement of goat. Ancient DNA allows populations prior to this be directly sampled. We present an initial analysis of whole mitochondria data from goat sampled from a range of time depths. We observed a high degree of mitochondrial diversity at earlier periods followed by a significant restriction which has shaped modern goat mitochondrial diversity. We also report a 14 thousand year old caprid mitochondrial lineage most similar to the Caucasian Tur (Capra caucasica), having diverged from it over 100,000 years ago.

Session: Animal-Human Interactions

Predicting archeological boar's lifestyle from their remains: Calcaneum morphology as plastic marker of captivity

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The Neolithic revolution, which corresponds to the beginning of animal and plant domestication and to the shift towards a sedentary lifestyle that is the root of our societies, is considered as a major shift of the human history. Understanding the early stages of the process is necessary to conduct research on the domestication history, which involve being able to distinguish archaeological remains of wild animals from remains of individuals in the earlier stages of domestication. This study aims to compare the calcaneum morphology from five french wild boar (Sus scrofa) populations, three captive wild boar populations, and 11 breeds of domestic pigs. The goal is to determine if it is possible to distinguish wild boars, captive boar and domestic pigs, and then to apply these potential results on samples from 7 archaeological french sites from the Mesolithic and Neolithic periods. Analyses were made from coordinates of 958 landmarks placed on 94 calcaneus 3D models: 27 wild, 23 captive, 31 domestic and 13 archaeological.The results have shown that the plastic deformations caused by the captivity are similar to hereditary deformations from the domestication syndrome, and that these deformations consist mainly in a twist of the epiphysis. Finally, predictions confirmed wild lifestyle for specimens from Noyen and Roucadour. They have instead determined that other specimens from Noyen 3 and Roucadour were probably rather captive or domestic, which can lead to change the assumptions about the arrival of domestic pig on these sites.

Foddering strategies among the earliest pigs in the NE Iberian Peninsula (5700-4500 cal BC): a stable isotope perspective

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Adoption of livestock was a transcendental turning point in the early Neolithic that resulted in significant changes in the social and economic organization of the first farming communities. The breeding and management practices of domestic animals implies the emergence of new work processes and the inclusion of new products in the human diet. Among the first domesticated species, pigs played an important role as suppliers of meat products in the Iberian Peninsula. The archaeological data currently available show a high degree of variability in the management practices. The diet of these first pig populations in the early Neolithic is one of the key elements needed to characterize the management system. Previous studies have shown the potential of stable isotopes for assessing variability in animal diet. In order to investigate the breeding conditions of pigs in the NE Iberian Peninsula, we selected an assemblage of pig bones from two early Neolithic sites, La Draga (Gerona) (5201-4721 cal BC) and Reina Amà lia-Caserna de Sant Pau (Barcelona) (5372-5076 cal BC), for carbon and nitrogen stable isotope analysis. The results reveal remarkable diversity in the diet of pigs between these sites, offering new elements for discussing the variability in foddering strategies and environmental conditions in these early farming communities in the NE Iberian Peninsula.

Of Cattle and Feasts: using multiple isotopes to understand short- and long-term management patterns of animals consumed during feasts at Neolithic Makriyalos

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The Late Neolithic site of Makriyalos presents evidence for large-scale consumption of domestic animals during communal feasting activities; a scale that is unparalleled in other Neolithic contexts. The aim of this study is to explore how these animals were obtained and managed in preparation for the feasts using a series of stable isotopic measurements. $\delta^{13}C$ and $\delta^{15}N$ values of human and animal bone collagen are used to assess the long-term nature of the animals' diets and their contribution to human dietary intake. Sequential $\delta^{13}C$ and $\delta^{18}O$ values from tooth enamel carbonate of sheep and cattle are used to explore the animals' seasonal dietary behavior and differential management strategies in their early lives. $^{87}Sr/^{86}Sr$ values from cattle tooth enamel carbonate are used to test the possibility that some of these animals were born and bread outside of the local landscape. The results reveal that individuals that were slaughtered during the feasts were not managed differently to individuals that ended up in 'non-feasting' contexts. Furthermore, the data suggests that some cattle may have been imported to the site from the wider geographical landscape along established exchange networks. In line with results from milk residue analysis (Evershed, 2008), the findings suggest that the birthing patterns of the animals were not controlled to secure supplies of milk throughout the whole year, speaking to their role in the subsistence economy of the farmers. The study demonstrates the usefulness of a contextualized multi-isotope approach for reconstructing aspects of ancient agricultural management.

Understanding the herd: An ancient DNA study of the cattle of Cladh Hallan

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Humans and cattle have lived together for millennia. Until the 21st century, size, shape, and demographic characteristics of cattle formed the key pathways for zooarchaeologists to explore the nature of this relationship. Whilst recent residue and isotopic analysis has shed light on the role of cattle in food production, the complexities of establishing and maintaining herds to human needs have remained hard to establish. The study of ancient DNA is one route that is allowing us to begin to examine the temporal dynamics of the human:cattle relationship. The combination of technological advancements in high throughput DNA sequencing and improved sampling techniques enables the sequencing of many more individual animals than previously possible, allowing us to compare the genomes of multiple animals across space and time. This paper presents the application of these technical advancements to examine the development of cattle farming at a single location in Britain. The remarkable preservation of DNA from individual cattle petrous bones recovered from the Bronze and Iron Age settlement of Cladh Hallan, South Uist in the Outer Hebrides, enabled the sequencing of nine individuals, spanning a time period from the Middle Bronze to the Iron Age. The increased genetic resolution and chronological depth allows us to begin to examine the genetic characteristics of this cattle population. We will demonstrate that applying population genetics techniques to ancient ‘herds' will provide new insights into human:animal interactions, including herd expansions or contractions, population persistence or replacement and enable individual cattle genetic biographies to be developed.

Poster Presentation Abstracts

P1

Shell mounds (sambaquis) and lithic artefacts: investigations in Southeastern Brazil

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Our goal is to explore the role of prehistoric stone technologies in shell mounds (sambaquis) studying the lithic assemblage recovered from sites located at the southeastern Brazilian coast occupied by fisher-gatherer-hunter populations since 8,000 years BP. Although there is still little attention applied to stone artefacts, a comprehensive study must include all types of artefacts found in sambaquis. We analyzed lithic artefacts from shell mounds located on the coast of São Paulo State (Southeastern Brazil), along the continental area and in islands, mostly from archaeological excavations carried out since the 1950's and also museum collections. Lithic artefacts in shell mounds range from flakes of small dimensions to polished stone axes and zooliths, lithic sculptures of animals found in funerary contexts, and can be related to domestic and also ritual functions.

P2

Consumption and ritual practices in Biniadris cave (Alaior, Mahon, Spain)

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Ritual and social practices are joined in a unique space in the Biniadris cave (Alaior, Menorca, Balearic Islands). This cave is a sacred space in which practices of burial and funerary offerings that accompanies women and men acquire a symbolic role. Here the life and death occur in a ritualistic environment totally premeditated and consented by the populations that inhabited these lands during the second and first millennium BC. Within this set of ritual practices, food practices (commensal practices) played a principal role as evidenced by archaeological record. But what kind of food was part of these practices? Were all the vessels used for a single food or, on the contrary, were they multifunctional? In order to achieve these goals, analytical techniques such as gas chromatography-mass spectrometry (GC-MS) has been used.

P3

Sediment accumulation and removal from cave stratigraphies - the importance of identifying stratigraphic residuality when interpreting people-landscape interactions preserved in caves in tropical Southeast Asia

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Sedimentation in karstic limestone cave floors is subject to complex stop-start mechanisms, especially where bone breccias accumulate. Archaeological research targets depositional archives preserved as bone or shell rich breccias, in contrast to more ubiquitous clast-cemented breccias and speleothems. Understanding stop-start mechanisms for breccia formation becomes critical when modeling presence-absence of human occupation. In mainland and Island Southeast Asia age-estimates for migration, dispersal and subsistence often date bioremains cemented as inclusions in breccias. This paper examines well-dated archaeological sequences excavated in caves in Timor-Leste and Papua New Guinea. These are cave sites where tectonics, late Quaternary sea level and local river catchment geomorphology are important drivers of a) cave stratigraphic formation and b) chronologies of gutting/filling episodes seen in breccia matrix formation and c) residuality identified in rock clasts, bone and shell inclusions cemented in breccia fabrics. This paper presents case studies from small river catchments in island karstic landscapes as bench marks against which to compare and re-assess models of cave deposit formation, and survival of archaeological stratigraphy through time, reported for large valley marginal caves in larger fluvial catchments in mainland Southeast Asia. A model is proposed which places the presence/absence of agencies for bone and shell sequestration from landscapes into caves, forming breccias, as best understood within geomorphological models which highlight local base levels and hydrology as determinants of deposit cementation and storage in karstic caves.

P4

Bioarchaeology: Living and death of a farming society in Sardinia, Italy (AD 1300- 1700)

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The analysis of human remains from archaeological contexts provides a set of informations for addressing hypotheses about what life was like in the past. They represent a biological archive of the society and an archive of the life experiences of every member of it from early childhood through adulthood, and especially those experiences relating to health and lifestyle. This paper presents an overview of health indicators documented in an ongoing bioarchaeological project involving the study of human remains buried along the north side of the Basilica of Saint Antioco of Bisarcio, located near the village of Ozieri, in the province of Sardinia (Italy). The countryside church, built in the 11th century A.D. and located on isolated vulcanic hill, has been the seat of the Catholic diocese of Bisarchium from 1065 to 1503 and it was rebuilt after a fire in 1174 A.D. Archaeological excavations have produced a sample of 24 skeletons with a chronology from the medieval to the modern periods. Study of skeletal and dental pathologies (osteoperiostitis, osteoarthritis, dental caries), trauma, and other evidences of living conditions reveals the lifestyle in this setting. The record of infections and poor oral health speaks about the poor circumstances of diet and poor health generally of this sample. The pattern of musculoskeletal stress markers and other occupational stress markers allows reconstructing the occupational activities of this community (intensive farming) that might have been related to them.

P5

Identification of seaweed consumption in sheep based on the concentration and distribution of arsenic in teeth

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Studies of dental $\delta^{13}C$ and $\delta^{18}O$ ratios and microwear have indicated seaweed consumption by sheep in Neolithic Orkney, but archaeological evidence of seaweed-foddering practices remains scarce. The development and application of additional methods to identify dietary seaweed contribution is thus necessitated. This poster presents research into the use of trace elements in teeth as biomarkers for seaweed consumption. A focus was placed on arsenic, given that seaweed-eating sheep are naturally exposed to dietary arsenic levels that are around 100 times higher than those of grass-eating sheep.Modern sheep molars (n = 10) were obtained from the island of North Ronaldsay, where sheep naturally subsist on a diet predominantly composed of seaweed, and additional molars (n = 10) were acquired from near-by grass-eating sheep. Using atomic fluorescence spectroscopy, arsenic concentrations ranging from 0.3 ± 0.03 to 2.9 ± 0.2 mg/kg were measured in pooled dentine, cementum and pulp samples of seaweed-eating sheep, which is over two orders of magnitude higher than in the grass-eating population. Using laser ablation ICP mass spectrometry, bioimaging of cross-sections of sheep molars showed that arsenic predominantly accumulates in cementum, as well as in occlusal dentine (exposed dentine on the chewing surface). While the accumulation of arsenic in tooth cementum may also originate from metabolic processes, increased arsenic concentrations at the occlusal surface are thought to occur due to direct contact with arsenic during mastication, indicating possible issues of diagenesis (including in vivo) when applied to archaeological samples.

P6

Long Live the Seaweed-Eaters: Radiocarbon and stable isotope analysis of human remains from the Neat's Court round barrow on the Isle of Sheppey, Kent

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Neat's Court is a round barrow site located on the Isle of Sheppey, Kent. Seven unburnt human skeletons were recovered from the barrow mound and the surrounding ditch. At least three dated to the Early Bronze Age, but two were Early Iron Age. This result adds to the existing evidence that some of the 'missing' Iron Age dead may be represented amongst unaccompanied round barrow burials previously assumed to be Bronze Age. The radiocarbon and osteological analysis of the final inhumation suggested it represented a Late Anglo-Saxon execution burial.

Strontium ($^{87}Sr/^{86}Sr$) and oxygen ($\delta^{18}O$) stable isotope analyses were performed on tooth enamel from 6 skeletons covering the whole temporal range of the site to investigate individual mobility. Strontium isotope ratios in all samples were similar to seawater, consistent with their coastal location. However all samples were also characterised by unusually high concentrations of marine strontium. Archaeological samples showing similar marine strontium concentrations have only been recovered consistently from British archaeological contexts on the Scottish islands, a phenomenon which has been attributed to the persistent use of seaweed as a fertiliser. The Neat's Court results may suggest that a similar long-lived cultural practice was present on Sheppey from at least the Bronze Age.

P7

X-Ray Vision: The use of micro-CT as a non-destructive method of analysing bone diagenesis and its application to the identification of Romano-British stillborn infants

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A recent histological study of diagenesis in European archaeological human bone found that an unusually-high proportion of young infants/perinates were free from bacterial tunnelling (bioerosion), which is thought to be produced by intrinsic gut bacteria. The best explanation for this result is that the unbioeroded infants were stillborn, as the human gut microbiome mostly develops after birth. The ability to differentiate between stillborn and short-lived infants would profoundly impact on the study of past human life courses and infanticide. Current histological methods are destructive and use single bone cross-sections that are potentially unrepresentative. Histological analysis of bone by x-ray microtomography (micro-CT) may overcome these problems, but is untested. We micro-CT scanned 3 archaeological samples of adult femora that had been analysed previously and 20 Romano-British young infant femora to assess the efficacy of micro-CT and investigate patterns of bacterial bioerosion in a novel infant sample set. The results confirm that micro-CT is an effective method of assessing bone diagenesis. Bacterial bioerosion appeared dichotomously amongst the Romano-British infant samples, replicating previous studies' results and supporting suggestions that histological methods are useful for discriminating between stillborn and short-lived infants. Rural and urban Romano-British cemeteries included different proportions of stillborn infants.

P8

Beyond the underground. An archaeo-social analysis for mortuary practices among Hunter Gatherer

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Archaeology of Hunter Gatherer Societies (HGS) and specifically, the study of funerary remains needs a new improvement to answer actual questions about social relationships between males and females. For too long many scholars have focused in the status system to later fall in the pure descriptions or abstract narratives away from the physicality of the body and the social contexts of life and death. To be able to access social knowledge using the funerary remains it is necessary to understand that the theoretical limits lie in the methodology and not in the archaeological record itself. As any other society, HGS had social norms and behaviour patterns that were materialized in ideological items, in the funerary record, or structuring different spaces. Here, a methodological approach based on a conscious record of the mortuary materiality is proposed, gendering the activities to finally arrive at the division of labour and social status based on gender. This is made on the basis of a renewed ethnoarchaeological point of view, where the materiality, inferences and interpretations are compared and contrasted. Yamana and Selknam societies from Tierra del Fuego are contrasted towards the European paleo-mesolithic societies. The results are satisfactory and suggest that new approaches can be made.

Through the discussion of the current mortuary archaeological record a critical analysis of the gender division of social activities and status is shaped. Thus, this is an attempt to establish a base to support the social reconstruction of prehistoric HGS, their dynamics, differences, and possible sexual asymmetries.

P9

Can we detect lake fishers? Using multiple modern human isotope signals to identify diet in tropical African populations

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Exploitation of aquatic resources is often seen as central to the development of cultural complexity. However, the inclusion of fish in the diet of past populations is often difficult to detect, particularly within freshwater environments. In this study, we analyzed human hair (n=134), nail (n=80) and breath (n=184) for $\delta^{13}C$ and $\delta^{15}N$ from 5 modern human populations with different subsistence patterns (pastoralists, hunter-gatherers, agriculturalists and three different lake fishers). The sampled African populations (ElMolo, Turkana, Luhya and Luo from Kenya; Baka from Cameroon) practice more traditional diets, thus controlling for the more widespread but historically recent Western diet. A diet questionnaire was also applied to these populations (with the exception of the Baka) to relate individual diet to traditionally reported diets. We found that agriculturalists and hunter gatherers differed from pastoralists and fishers, but it was not possible to distinguish between pastoralists and fishers. This latter result might be due to a nitrogen depletion in Kenyan lakes, which makes the inclusion of fish in diet in this area hard to detect. The results emphasise the importance of local factors in isotope values, and the variable sensitivity of isotopes to dietary practices as a result of these local conditions.

P10

What commercial archaeology can offer to archaeometallurgy: a case study of iron smelting

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Commercial archaeological companies produce the majority of archaeological data in the United Kingdom, but the majority goes unused by research communities, especially within the field of archaeometallurgy. Instead, research communities often rely on data from research excavations. While these are still able to produce important findings, they cannot compete with the sheer volume of data that is produced from commercial archaeology. The high volume means that commercially excavated sites are more varied in terms of location, scale and importance and are therefore better placed to provide material to fill in the blank areas of the archaeological picture. In addition to the extra material that commercial archaeology could provide to the research community, the archaeologist and archaeometallurgist could also learn from each other. For example, as the discovery of iron smelting sites has increased - especially from less archaeologically visible periods - the two fields have been able to learn from each other. This recent collaboration has the potential to change the archaeometallurgical picture, with new sites dating to the Iron Age and Anglo-Saxon periods showing more variation in scale and location than previously thought. The legal requirement for commercial archaeology to be a part of commercial developments means that the United Kingdom is well positioned for a collaboration that could move archaeological science forward by leaps and bounds. Commercial archaeology needs to be a key collaborator, not just a distant relative or a revenue stream.

P11

A modern conflict: Archaeological theory, violence and the vacuum of gender archaeology

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With little published work on the subject of gender archaeology, it is widely recognised in the archaeological community that gender and biological sex are all too often diagnosed based on funerary analysis, artefacts and our own modern bias. This talk challenges these conceptions, citing skeletal evidence to understand levels of conflict and violence in medieval and post-medieval London. Through the comparison of levels of violence and wound locations between the sexes, we can observe social trends that indeed conflict our own modern of ideas.

P12

Diet in a Templar town: Medieval Portuguese diet from carbon and nitrogen stable isotope ratios

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The aim of this study is to reconstruct medieval human diet in Tomar, Portugal, using stable isotope analysis of bone collagen. Tomar's medieval necropolis was used from the 11th to 16th centuries, a period in which Portugal went through various socio-cultural and political changes; from the Reconquista to civil war and the Age of Discoveries. Tomar was a Templar town located on the main Portuguese route connecting the North of the country to the limits of the Reconquista. Historical textual evidence highlights differences in meat consumption in Templars compared to individuals with similar social status. It is possible that these dietary restrictions were reflected in the population in the form of angling and warren rights, which were shared betweenthe Crown and the Military Orders. Conversely, merchants, crafters and farmers participated actively in the local army alongside knights, increasing their status and most likely their access to similar food resources.In this study, carbon and nitrogen stable isotope ratios from bone collagen were analysed. Forty skeletons were sampled (20 males; 20 females) to investigate diet in this population and possible dietary differences between males and females. Faunal remains (herbivorous, carnivorous and omnivorous) were also analysed to reconstruct a dietary baseline. This town's rich history makes it very interesting for dietary reconstruction, shedding light upon medieval Military Orders and their influence on the civil population.

P13

The identity of the mysterious 'new glume wheat' of early European agriculture

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‘New glume wheat', NGW is unidentified, extinct today Triticum species, formerly classified as 'aberrant' or 'slender emmer'. Its close relationship to modern tetraploid Timopheevii wheats has been proposed with respect to spikelet bases and the grains. In prehistoric times NGW could have been a widespread crop with archaeobotanical records ranging from Anatolia to Western Germany, from various cultures from the Early Neolithic to the Iron Age. Domesticated T. timopheevii is not a common species; being restricted to localized regions of Georgia. The aim of the project is to establish the identity of the NGW- to distinguish if archaeological tetraploid NGW is related to araraticum-timopheevii (AtAtGG) or to dicoccoides-dicoccum (AuAuBB) group. Archaeobotanical study is not sufficient in diagnosing definite taxonomic identification of the NGW. However, there are unambiguous differences at the molecular level: Timopheevii Wheat possesses the G and At genomes; whereas emmer's genomic composition is B and Au. The specific objective of the project is therefore to use ancient DNA (aDNA) sequencing to determine if the NGW contains a B or G genome. Plant material consists of 41 T. timopheevii, 13 T. araraticum, 7 T. dicoccoides, 4 T. dicoccum accessions and charred NGW grains from Assiros Toumba, Greece. We will de novo sequence variable regions of at least 50kb of the G genome in order to identify diagnostic polymorphisms, apply target enrichment and then sequence targeted aDNA from charred cereal grains.

P14

Fishy Ways of Grey: A Multi-Isotope Study of Diet and Mobility at the Medieval Franciscan Friary, Aberdeen

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Founded in 1469, the Franciscan Friary was one of several religious houses in medieval Aberdeen, along with Dominican and Carmelite Friaries. In 2009, during the re-development of Marischal College into the new headquarters of Aberdeen City Council, archaeologists unearthed stone walls associated with the mid-15th century structure at the site and a series of seven burials of older male individuals with their hands clasped, buried with their heads to the SW against a cloister wall. Radiocarbon dates suggest these individuals originate from the 15th - 16th century AD, and it has been speculated that they may represent some of the first Greyfriars of Aberdeen. As part of a wider project on diet and mobility in medieval Aberdeen, multi-isotope approaches have been employed to explore the diet ($\delta^{13}C$, $\delta^{15}N$) and geographical origins ($^{87}Sr/^{86}Sr$, $\delta^{18}O_{CARB}$) of these individuals. Stable carbon and nitrogen isotope values obtained from bone collagen samples suggest low inter-individual dietary variability, and a prominent reliance on marine resources, likely marine fish. This contrasts with dietary stable isotope data from high-status lay communities in medieval Aberdeen (St. Nicholas Kirk), and may attest to the Greyfriars' strict adherence to religious fasting rules. The isotope composition ($^{87}Sr/^{86}Sr$, $\delta^{18}O$) of paired M2 and M3 tooth enamel samples from each individual suggests a lack of residential mobility in later childhood and (likely) local origins for most of the individuals.

P15

Dying in the Neolithic: isotope analysis of the Late Neolithic mass grave of La Sagrera, Barcelona

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The recent excavation of the Late Neolithic mass burial of La Sagrera (Barcelona), raised questions regarding the reason for the mass inhumation and the relationship of this group with coeval populations in the area. Isotope analysis of thirteen individuals has shed light on the provenance and diet of those buried there. Strontium isotope analysis revealed a largely local group, with the majority of individuals falling within expected local biosphere values, and some individuals with elevated values probably reflecting migration from regions north and east of the site. The $\delta^{18}O_{DW}$ values of this group are significantly lower than expected for coastal Barcelona, almost 3‰ below local modern rainfall estimates. In an attempt to understand the diets of the individuals, bulk and incremental dentine collagen analysis were conducted, revealing two isotopic groups distinguished by age at death. Individuals that died during childhood had elevated $\delta^{15}N$ and $\delta^{13}C$ compared to those that died in adulthood. The elevated values may be the result of stress prior to death and/or increased marine consumption in response to food shortage such as crop failure, as proposed for the Neolithic population in the Shetland Islands (Montgomery et al. 2013). In contrast, the low and flat $\delta^{15}N$ and $\delta^{13}C$ profiles observed in the adults point at a diet dominated by agriculture, as expected from a Late Neolithic population. These results in connection of the absence of skeletal evidence indicative of violence, suggests the burial may have served the largely local population following an epidemiological or famine event.

P16

Reconstructing palaeoenvironments in archaeology: The foraminifera and ostracods of the Burtle Beds, Somerset, during MIS 5e

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The Burtle Beds in Somerset are one of the best known Quaternary Formations in the UK. There has been much debate about the age range of these deposits and their relationship with other geological formations in the surrounding area. The upper part of the sequence has been dated to the last interglacial period (MIS 5e) using AAR (Amino Acid Racemization), however the bottom half of the sequence is particularly under-studied and may include glacial deposits. The Ussher Society awarded a grant for the fieldwork carried out at Greylake, which involved sampling one of the best open sections of the Burtle Beds seen for some time. Subsequent processing was carried out at the Natural History Museum and the project is now in its early stages of analysis. This paper demonstrates how foraminifera and ostracods can be used as proxies to reconstruct past environments, and in this case, investigate coastal conditions around South West England in MIS 5e. This has a bearing on a major debate in archaeology: why humans were present along the coasts of Northern France, but appear not to have been present the UK in MIS 5e.

P17

Disentangling the expansion of major European mitochondrial DNA lineages

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Phylogenetics aims to investigate the evolutionary history within or between species by identifying relationships between DNA sequences comparing multiple genomes. Looking at the female line of descent, the majority of the modern-day European population (~40%) belongs to mitochondrial (mt) DNA haplogroup H. However, its sister clades within HV(xH,V) are observed at higher frequencies in Southern Europe and the Near East and most of these show a post-glacial expansion, suggestive of a Near Eastern origin and subsequent Mesolithic spread into Europe. On the other hand, analysis of ancient DNA infers that haplogroup H first appeared in the Early Neolithic, with the lineages that subsequently came to dominate across Europe becoming established during the Middle Neolithic period. H reached higher frequencies again during the appearance of the Bell Beaker culture in the Copper Age, but its complex evolutionary history makes it still uncertain when and how H became the dominant European haplogroup. Its most common subclades in Western Europe are H1 and H3, which peak in their abundance in modern Iberia. Using phylogenetic and founder analysis, we estimate arrival times of HV(xH,V), H1 and H3 in Central Europe and the British Isles, thus disentangling population movements out of Iberia at different times. Our results show differences in the arrival times of H1 and H3 to Central Europe and the British Isles, with H1 having been involved in more expansions than H3.

P18

TRACER ("Tree Roots: an analytical 'culture' of economy and religion- case-study Egypt 2050-1550 BC"). Presentation of an archaeometric project in Egyptology

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Indigenous and imported wood species were extensively used in Ancient Egypt for manufacturing objects of daily life and equipment for the afterlife, notably statuary and coffins. Despite the abundance and use throughout Pharaonic history, no global study has been carried out on this material. The TRACER project will be developed at the Institute of Archeology of UCL until the autumn 2018. It will lay the foundations of a global project dedicated to wood in Ancient Egypt. This Marie Curie Fellowship project is entitled "Tree Roots: an analytical 'culture' of economy and religion- case-study Egypt 2050-1550 BC". With an innovative double methodology combining archaeometric and theoretical approaches, the project will analyze woodcraft as a societal "tracer" in Ancient Egypt during the Middle Bronze Age. Combining stylistic and technical analysis, archaeobotany, analytical chemistry, 3D scanner for the study of tool marks and dendrochronology, the main objective of TRACER is to highlight how the specialized production in one material, carpentry, correlates with the other dimensions of its historical context (religious, political, cultural). This conference will be an opportunity to present the methodology implemented for the development of the project and the objectives envisaged. In order to illustrate the potential of this project, I will present the results obtained during my PhD on a specific category of objects, funeral wooden models. Beyond the purely stylistic aspects, the archaeometric analyzes carried out on this furniture made it possible to identify workshops, methods of manufacture and to specify a chronology.

P19

Bone deep: stable nitrogen isotope ratios and histomorphometric measurements of bone remodeling within adult human skeletons

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Stable carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) isotope studies of ancient human diet increasingly sample several skeletal elements within an individual. Such studies draw upon differences in the rate that bone tissue renews, to reconstruct diet during different periods of time. Rib and femoral bone, with their respectively fast and slow remodeling rates, are the bones most often sampled to reconstruct shorter and longer term signals of diet prior to death. Whether $\delta^{13}C$ and $\delta^{15}N$ values vary in other bone types within a human skeleton, or if this variation corresponds with the rate in which bones remodel, is poorly understood. Here, we reconstructed $\delta^{13}C$ and $\delta^{15}N$ ratios for ten different bones within ten adult human skeletons (n=5 males; n=5 females). Isotope values were compared to the rate that each bone remodeled, calculated from osteon population density. Results reveal that isotope ratios changed within each skeleton ($\delta^{13}C$: max= -1.58‰; $\delta^{15}N$: max= 3.05‰). Humeri, metacarpals, and ribs had the highest rate of bone remodeling, the occipital had the lowest. Regression analyses show that higher rates of bone remodeling are significantly and negatively correlated with lower $\delta^{15}N$ ratios, when compared between skeletons. Our results suggest that the occipital bone, with its slow rate of bone renewal, may prove useful for isotopic studies that reconstruct diet over longer periods of time within an individual's lifetime. Isotope studies that compare individual skeletal elements between populations should standardize their methodology to bones with either a slow or fast turnover rate.

P20

The peopling of Sabah, Malaysia through phylogenetic analysis: A literature review

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Through archaeological and linguistic evidence, it has been proposed that proto-Austronesian speakers and rice agriculturalists from South China dispersed into Taiwan at c. 5500 ya, and later the Austronesian speakers spread into Island Southeast Asia, Polynesia and Oceania after 4000 ya. The indigenous people in Sabah (Borneo, Malaysia) all speak Austronesian languages, such as the Dusun and Bajau languages; this signifies an arrival and colonisation of Borneo after 4000 ya or an admixture and language adaptation between the local populations. However, recent genetic studies have shown that the picture is much more complex than this. Yet, there is only a very small number of phylogeographic studies conducted in Sabah as opposed to the extensive phylogenetic studies conducted in neighbouring countries such as Indonesia and the Philippines. Here, we focus on the currently available literature relating to past population migrations and the settlements of Sabah, with an emphasis on phylogenetic analysis using mitochondrial DNA (mtDNA). This literature review aims to highlight the major gap that is currently present in phylogenetic studies of populations from Sabah (or Borneo), which impedes us from a better understanding of migrations and settlements of past people from the wider region.

P21

Intra-site analysis as an archaeological approach to social norms in Hunter-Gatherer societies: testing the ethnoarchaeological data of Tunel VII (Tierra del Fuego, Argentina)

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The European Upper Palaeolithic and Mesolithic record has numerous elements that relate to the ideology of HGS. However, despite few proposals, research in Prehistoric HGS has traditionally considered social norms as archaeologically invisible or as a fertile ground for speculation. On the other hand, the study of modern Hunter-Gatherer Societies (HGS) puts forward the recurrent presence of gendered division of labour and social asymmetries. According to the extensive ethnographic record, these relationships are mainly modulated by social norms, which materialized in ideological items but also in the arrangement of different social spaces. In order to test the explanatory potential of intra-site analyses an ethnoarchaeological approach was developed. Emphasis is placed on Tunel VII archaeological site (Tierra del Fuego, Argentina). Tunel VII site is a shell midden located in the northern coast of the Beagle Channel. Archaeological work was carried out between 1989 and 1993 in the framework of several Spanish-Argentine projects. The site has been interpreted as a 19th century Yamana hut with ten short successive occupations episodes. Ethnographic literature describes the Yamana as high-nomadic groups with strict gendered division of labour that intensively exploited the littoral resources. Ethnographic and archaeological data were combined to propose significant associations between production and consumption activities and the spatial distribution of their waste and debris. These archaeological markers were used to identify recurring spatial patterns in Tunel VII. The results presented reveal that social-division of space can be detected in the archaeological record by means of appropriate methodology.

P22

Caribou and Climate Change: Reconstructing Rangifer Seasonal Biogeography in late Holocene Alaska using Intra-Tooth Isotope Analysis

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The palaeobiogeography of prey-species can provide valuable insights into human subsistence choices and landscape use in the past. In many contemporary indigenous Arctic societies, caribou are an important seasonal subsistence species, and recent climatic shifts have influenced the seasonality, distribution and migrations of herds, impacting subsistence activities. The impact of larger scale climatic change on these species, such as that experienced during the Little Ice Age (LIA), is not known, but may provide vital clues about future variability, as well as illuminating past subsistence strategies. Here we present sequential strontium ($^{87}Sr/^{86}Sr$) and oxygen ($\delta^{18}O_{CARB}$) isotope data from archaeological caribou (Rangifer tarandus sp.) tooth enamel from Nunalleq, a precontact village site in Western Alaska, in order to reconstruct caribou migratory patterns in this region during the LIA. The results of these analyses highlight variation in ranging habits over the short period of time when the site was occupied, and also indicate different ranging behaviours in the region in the past compared to modern herds. The isotopic data presented here evidence change in caribou seasonal biogeography in late Holocene Alaska, and complement the wealth of data derived from other research at Nunalleq, illuminating the influence of changing climatic conditions on prey-species palaeoecology and human-animal interactions at the site.

P23

Isotopic evidence from archaeological fish shows significant environmental change in past Great Lakes ecosystem

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To understand how natural and anthropogenic forces are reshaping aquatic environments, biologists have created isotopic baselines using archived fish tissues (e.g., scales and flesh) to detect changes in environmental conditions in the recent past. Most baseline datasets begin in the twentieth century, long after major developments such as the industrial revolution began to have serious environmental consequences and are unable, therefore, to provide information on longer-term processes in aquatic ecosystems. This study presents stable nitrogen isotope compositions of archaeological bone collagen from over 200 fish as a proxy measure for long-term (A.D. 1000-1900) environmental changes in Lake Ontario, the most easterly of the Great Lakes, with the longest history of intensive exploitation. Results show a significant shift in the $\delta^{15}N$ values of multiple fish taxa, consistent with a change in the state of the freshwater nitrogen cycle of Lake Ontario during the nineteenth century. This shift is likely linked to human-induced changes in the lake's nutrient and trophic structures. These findings provide fresh insights into the broader environmental context of the impact of European settlement in the region.

P24

Economic change and urban development in medieval Odense (Denmark)

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The medieval site Thomas B. Thrigesgade (Odense) was excavated between 2013 and 2014 by Odense City Museums. The high research intensity at the site provides a good background for the analysis of economic changes and urban development based on the material culture as well as organic remains.

Good preservation conditions at the site, combined with the large size of the excavated area, provide a detailed insight into the development of a city quarter, by including samples from street layers, as well as soil samples from houses, brewing houses, stables, refuse deposits and latrines. This paper focuses on the botanical remains derived from various contexts to assess spatial and temporal patterns in food economy and development of the urban environment at the site between the 11th and 16th century CE.

P25

Oh we do like to be beside the seaside: A bioarchaeological study of the early medieval cemetery of St Patrick's Chapel, Pembrokeshire

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The early Christian cemetery of St Patrick's Chapel is situated in sand dunes overlooking Whitesands Beach, Pembrokeshire. As part of a collaborative project between the University of Sheffield and Dyfed Archaeological Trust, three seasons of excavation took place between 2014 and 2016 after human remains were exposed from the dunes during the severe winter storms of 2013/2014. Excavation of the cemetery has revealed a significant burial site with over 80 burials excavated to date, and radiocarbon dating suggests the cemetery was in use between the 7th and 11th centuries AD. There was considerable variation in the burial forms, including the use of stone-lined cist graves, double burials, cross-inscribed grave markers, and the use of quartz-topped burials reserved specifically for non-adults. Indeed, there appears to be a high concentration of non-adults buried at this site, including a number of foetuses and infants. This poster presents the latest results of the osteological and stable isotope analyses undertaken on the human remains from St Patrick's Chapel, and provides a unique insight into this early medieval coastal community.

P26

A Systematic Review of Spatial and Temporal Change in Prehistoric Human Diets in British Columbia, Canada

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Some of the first ever studies on the use of isotope analysis as an indicator of past human diets were undertaken in British Columbia in 1982. Since that time, there has been an accumulation of new data, but much of it is in so-called 'grey-literature' from commercial archaeological reports, as well as various unpublished datasets. This study represents a systematic review of all of the available stable isotope data from archaeological human remains in British Columbia. Isotope signatures for coastal individuals correspond well with the heavy marine specialization attested to by archaeological and ethnographic studies of traditional Northwest Coast diets, as well as the earliest isotope studies on these populations. Within this marine specialization, the data for coastal sites indicates some degree of regional dietary variability. No large-scale temporal shifts are present, with δ-values remaining within a consistent range across a five thousand year period. In addition, there is no apparent trend towards intensification, with dietary diversity remaining consistent. Despite the near universal marine specialization, notable outliers exist throughout the coast, with several cases of fully terrestrial diets. For the sites in the interior of British Columbia, diets are much more variable, representing a range between purely terrestrial to mixed marine (anadromous fish) and terrestrial. Along salmon-bearing rivers, the marine component of diet is positively correlated with downstream proximity to the ocean. Altogether, these data demonstrate the importance of aquatic foods in the diets of First Nations peoples in British Columbia over thousands of years.

P27

The arrival of mountain hares to the Outer Hebrides of Scotland: an ancient DNA study

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The Outer Hebrides were first settled by humans in the Mesolithic period. This was discovered 16 years ago by an excavation uncovering a Mesolithic midden site, Northton on the Isle of Harris. Not only does this discovery confirm human presence was earlier than previously thought, it also led to subsequent excavations in the area revealing more Mesolithic sites. Each of these sites has yielded faunal evidence. These bones help us to reconstruct past diets, climate and may even give us insights into the Mesolithic people's trade routes or possibly even the origins of the people themselves. This phylogeographic study focuses on one species from the faunal assemblage, mountain hares. It is an investigation into the origins of this non-native species and how they came to be on the fringe of Europe. It will be possible to establish a time and method of colonisation by investigating the mountain hare bones from the Mesolithic layers from sites across the islands through a combined approach using phylogeographic, archaeological and climatic information. The likely sources of origin are Scotland, Ireland, England or Scandinavia. It is unlikely the hares could colonise unaided. Discovering which population the hares demonstrate the closest genetic similarity with, will further our understanding about the Outer Hebrides past connections to the rest of Europe. My work will contribute to the wider understanding of hare phylogeny, adding genetic data from the western most edge of their distribution.

P28

Species Identification of Mesolithic Bone Revealed by Ancient Proteins

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Preserved organic material from the Late Glacial and the Early Holocene in Southern Scandinavia is scarce. So scarce in fact, that faunal assemblages from this period cannot conclusively demonstrate species present at the time. Artifacts made of animal bone however, are preserved, often in the form of bone points lost during hunting in the newly formed lakes just prior to the last Ice Age. This presentation presents an overview of a new Ph.d project, which focuses on the application of Zooarchaeology by Mass Spectrometry (ZooMS) for species identification performed on Stone Age bone tools and fragments from Southern Scandinavia and Northern Germany.

P29

Mineralogical and chemical characterization of ceramic findings from a kiln/workshop in the small theatre of ancient Ambracia in Epirus,Greece

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This study deals with the characterization of ceramics from a Byzantine kiln in the small theatre of ancient Amvrakia, one of the smallest ancient theatres in Greece, which is located in the contemporary city of Arta, Epirus, NW Greece. Recent excavation works revealed the existence of a unique updraft kiln. A remarkable variety of ceramic findings were discovered inside the kiln in different excavation layers. They include pottery artifacts (potsherds of glazed vessels with slip, unglazed wares with slip, a clay tripod stilt, vessels without slip and ceramoplastic decoration elements, like tiles and bricks). The aim of this work is to present the preliminary results of the archaeometric characterization of the findings, to investigate the nature of the raw materials used for their production, and to obtain information on their manufacturing technology. The samples were examined by mineralogical (XRD) and elemental (XRF-WDS) techniques. A more detailed observation of the morphology and texture of selected shards were performed by SEM/EDS analysis. The mineralogical composition of the studied ceramics is marked by the dominance of quartz. The presence of certain minerals like, hematite, diopside and feldspars provided information about the potential firing conditions applied in the lifespan of the kiln. Chemical analysis results assisted the classification of the samples in different compositional groups. The examined ceramic findings are derived mainly from local calcareous clay resources. The results of this study strengthen the belief of the existence of an important local ceramic kiln/workshop throughout the Byzantine era.

P30

Europeans, Polynesians and Chickens: An archaeological and genetics approach to the natural and cultural history of chickens in South America

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The arrival of the chicken in South America has drawn much attention, yet it remains unresolved. One scenario sees a pre-Columbian Polynesian introduction via the western coast in Chile while another argues for a European introduction in the east. This debate has relied almost solely on a few bones found at the site of El Arenal-1 in Chile, and radiocarbon dated to 50 years prior to the arrival of the Europeans in this region. However, this radiocarbon date could be pushed back to post-date the European arrival due to the marine reservoir effect, as the bones were recovered from a context heavy in marine resources and the site is located only 3kms from the coast. Most surprisingly, no radiocarbon dating or genetic analyses have been conducted on archaeological chicken bones from other colonial and post-colonial sites across South America. Combining history, archaeology and genetics, our research aims to establish the geographical distribution and genetic diversity of chickens in Chile and Argentina at the onset of the colonial period as well as asses the chickens' social, ecological and economic impact on Chilean and Argentinian societies and native biota from their introduction to the present day. This paper presents a review of what recent genetic research have revealed on the introduction of chickens in South America before presenting preliminary observations and results conducted on a chicken bone assemblage from Fuerte San Rafael del Diamante (Mendoza, Argentina), first Spanish colonial fort of the region.

P31

‘A Pig of a Problem’. Unpicking $\delta^{15}N$ trophic systematics at the individual amino acid level

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Stable nitrogen isotope ($\delta^{15}N$) measurements in bone collagen are routinely used to assess trophic level in both modern ecological and archaeological palaeodietary contexts. The assignment of trophic level is based on the well observed phenomena that $\delta^{15}N$ increases by between 3 and 5‰ between diet and bone collagen. Despite the repeated observations of this phenomena by various workers a detailed understanding of the nitrogen trophic level effect is still lacking. At a fundamental level all bulk collagen $\delta^{15}N$ are a weighted average (by % N) of their component amino acids and it is changes in the $\delta^{15}N$ composition of the amino acids that must drive the observed changes in bulk collagen $\delta^{15}N$.

We will present the results an investigation into the nitrogen trophic level effect using samples from controlled feeding experiment conducted at the University of Bristol. We have measured both bulk $\delta^{15}N$ and individual amino acid $\delta^{15}N$ values in a wide range of body tissues as well as the dietary feeds to attempt to improve the understanding the observed increase in $\delta^{15}N$ with trophic level.

P32

17th century mass plague pit from the Bedlam burial ground- an isotopic study of diet

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The Bedlam Burial Ground was in use from 1569 until 1714. During the cemetery excavations in 2015, a mass pit with 42 individuals was found, dated to 17th century. Sample of one tooth and a rib was collected from 10 individuals from the site, with a same control sample size collected from another (non-plague) area. The aim of this research is to analyze the diet of the individuals using light isotope analysis of carbon and nitrogen. This will hopefully help in reconstruction of histories of the individuals by telling how did they live or what did they eat. Moreover it will be possible to reconstruct the quality of their life, which can help to reconstruct habitual changes due to possible migrations. It will help to answer the question if those changes could in fact be connected to plague infections, as for the first time DNA testing on these individuals has confirmed the identity of the bacteria responsible for the Great Plague of London, making individuals more susceptible to diseases or the nutritional statues might not matter and there was no selectivity regarding preexisting health conditions.

P33

Selection on a domestic chicken gene affecting reproduction and behavior coincides with medieval religious dietary reform

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A number of statistical approaches have been developed in recent years to detect and quantify the strength of natural selection using modern genomic data. However, these approaches all have poor temporal resolution. Ancient DNA allele frequency data provides the most direct and sensitive alternative for detecting selection at specific loci, and offers the possibility of resolving temporal variation in selection strength. However, ancient DNA sample sizes are typically small, and samples tend to be sparsely and unevenly distributed in space and time. In addition, all approaches are sensitive to confounding effects of demography. Here we present a Bayesian framework for reconstruction allele frequency trajectories through time from ancient allele frequency data that can explicitly accommodate the confounding effects of gene flow between populations and uncertainty in sample ages. We applied this method to ancient European domestic chicken genotype data from TSHR locus, which has been argued to be under strong and recent selection in domestic chickens. We find that he derived variant in TSHR, associated with reduced aggression to conspecifics, shows strong selection beginning around 1,100 years ago, coinciding with a European-wide known shift in poultry management between the mid-ninth to mid-eleventh century. This shift is associated with religious but also a legal rule that required people to abstain from quadruped meat, brought in as part of the Benedictine reform. This work directly highlights the importance of ancient DNA and statistical modeling for understanding how cultural practices in the past have shaped modern domesticated species.

P34

Raw source materials in Minoan mudbrick production

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This paper investigates the types of raw source materials used in mudbrick manufacturing in Bronze Age Crete. The research main goal is to analyse integrated trends of exploitation of vegetal temper and sediments in coastal and non-coastal settlements during the Minoan period. Specific case studies will highlight the changes in mudbrick manufacturing during the Bronze Age with a focus on the marine species used and how they are linked to technological development in building construction. This study seeks to combine evidence from geoarchaeological and architectural analyses into a new framework so that the results can help us extend our knowledge of earthen construction and its employment during the Bronze Age. The archaeobotanical data in conjunction with the geoarchaeological records highlights pattern of standardisation and specialisation of mudbrick recipes. The key aspect of this research is the focus through geoarchaeological analysis (XRF, XRD, FTIR and thin section petrography) and archaeobotanical identification on understanding the reasons of specific marine vegetal species selection and usage. The final aim is to investigate the issue of isolation and connectivity in relation to architecture craft specialisation, raw source material procurements and selection choices.

P35

Technological characterization of molded Islamic pottery from Mértola (Portugal)

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This work aims to investigate the production technology of a very rare and specific type of Islamic molded pottery found in Mértola (Portugal) in the context of Islamic archaeology of the Iberian Peninsula (Almohad period), questioning the origin of raw materials and the manufacturing processes. However, specialized studies of Islamic pottery have been a neglected subject in the local archaeology, therefore this study will try to contribute to the development of a broader discussion focused in this specific and rare Islamic pottery group. Therefore, main focus of this work will be to determine production technology of unglazed Molded Ware through the reconstruction of technological sequences or chaînes opératoires (selection and processing of the raw materials, forming, surface treatment, decoration and firing conditions). The final aim is to contribute to the general knowledge of the population that used this type of ceramic technology, in terms of what were their technological choices and whether pottery was reserved for the higher social classes (if we consider the fact that this type of pottery is exceedingly rare in the whole Iberian Peninsula). Moreover, one of the research questions will be to determine what was the provenance of this archaeological findings in order to obtain information about whether they were locally produced or imported. A multi-analytical approach which includes the study of mineralogical composition through pXRD and μXRD, as well as chemical composition via LA-ICP-MS and SEM-EDS has been integrated for the purposes of this study.

P36

Reconstructing the seasonality of occupations of El Mirador cave (Sierra de Atapuerca, Spain) during the Neolithic: isotopic evidences

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The El Mirador cave is an archaeological site located on the southern slope of the Sierra de Atapuerca, in the North Center of Spain. The cave was occupied from Early Neolithic to the Bronze Age (VI-II millennium cal. BC) and pastoral activities played an important role. A seasonal rhythm of occupation of the cave has been suggested from caprinae demographic profiles, considering estimation of age of death from dental series. In this contribution we present the first results of a sequential oxygen ($\delta^{18}O$) isotope analysis in tooth enamel sheep specimens, all recovered from Neolithic levels. Sheep second molars (M2) (NISP=10) with completely mineralized crowns were selected for analyses. Sequential $\delta^{18}O$ series had been modeled and compared with modern reference data sets. Seasonal reproductive patterns obtained from dental series suggest that seasonality of birth was constrained from late winter to early spring in all specimens analyzed. This information is used to precise season of death from dental series. Final results are used to reconstruct the occupation rhythm of the cave in a seasonal basis.

P37

Amphorae production in the Greek settlement Pharos (Hvar), Croatia: petrographic and chemical characterisation

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Pharos is the Greek polis on the island of Hvar on the Croatian side of the Adriatic Sea, founded in 385/4 BC by the Parians from the Aegean island. It is situated in a deep bay and on the edge of the fertile plain Chora Pharoi– the largest plain on the Mid-Adriatic islands, today at the UNESCO's list of protected heritage. Extensive archaeological excavations in Pharos have revealed a great number of ceramic finds from the late Classical and Hellenistic periods. Among them especially numerous were fragments of amphorae and fragments of poorly fired amphorae discarded as waste. These finds, together with stamped amphorae with name Pharos found on the indigenous settlements in the East Adriatic hinterland, set the hypothesis of the Pharian amphorae production. Furthermore, recent excavations reviled remains of the pottery kiln on the south-east corner of the settlement. It seems that kiln was destroyed during the building of the new fortifications after the I. Illyrian war in 228 BC. This give us a timeframe for the functioning of the kiln, and workshop at this part of Pharos, from at least the second quarter of 4th till last quarter of the 3rd c. BC. Optical microscopy on this sections and chemical analysis, conducted at the Department of Geosciences at University of Fribourg, were carried out on amphorae fragments unearthed in the vicinity of the kiln and in layers chronological associated with the time span of the kiln. Most of them belong to so called type B amphorae, Greco-Italic and a few samples belong to Lamboglia 2 amphorae. The analyses have revealed that potters used different past preparation for different types of amphorae. The results of the chemical analysis on amphorae and their comparison with local geological clays and with the available results from other amphorae production centres, confirmed the local production of different types of amphorae in Pharos – so called type B amphorae and Greco-Italic amphorae. Some analysed fragments are much closer in their chemical composition to Greek, namely Corinth/Corfu production and some to South Italian, namely Calabria production. These results open up a question of wine commerce in the Adriatic-Ionian-South Italian region during the Hellenistic period.

P38

Isotopic indicators of dietary change at Knossos under the Roman Empire

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The Hellenistic, Roman and Late Antique periods at Knossos, Crete, represent a major cycle of urban development and decline, from the growth and expansion of the settlement during the Hellenistic period, to its establishment as a Roman colony in the 1st century BC, and into a period of gradual decline during the Late Roman and Early Byzantine periods. Using stable carbon and nitrogen isotope analysis of bone collagen to identify characteristics of human diet, an investigation of changes over time and variation within the population, by sex or burial type, is presented. The Hellenistic population growth, Roman invasion and subsequent establishment of a colony at Knossos would have resulted in increased trade, new contacts and changes in political administration, introducing new produce, technologies and fashions that would have affected a change in the diet. A reduced population size in the Late Antique period could have lessened the pressure on resources and increased per capita income, and changes in politics, trade, land ownership and food distribution could all have resulted in changes in diet. Additionally, environmental considerations including particularly warm, wet conditions during the 1st century AD on Crete and significant aridity and cooler temperatures from 2nd-5th centuries, had significant ramifications for agriculture, productivity, and consequently diet. The significance of the changes in diet are assessed in terms of the internal dynamics and the broader context of Knossos' changing off-island importance within political and economic networks, rooting this research within the wider themes concerning urbanism, economy, demography, environment, colonisation, and migration in Crete and the Mediterranean.

P39

Resources movement, paleodiet, and feasting: Reconstructing human-animal interactions at Chinikihá, Chiapas during the Late Classic Period using stable isotopes

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The archaeological site of Chinikiha is located in the southern portion of Chiapas, Mexico that has its main occupation during the Late Classic Period (700-850 AD), a period of increasing political competition and alliances formed with the nearby sites of Palenque and Pomoná, amongst others. The Late Classic is characterised by a period of extended exploitation of natural resources by the ruling elites of all Mayan capitals, who also engaged in a series of activities to display their power and wealth, including ritual and political feasting. In this paper, we explore the role of Chinikiha in this framework and the role of animals used in feasting events, mainly white-tailed deer (Odocoileus virginianus). Using carbon and nitrogen isotope analysis, we were able to explore differences in access to ritual resources by class and gender. The results suggest that this was an activity where males were consuming more meat than females, especially those from higher classes. We were also able to reconstruct exploitation patterns where deer were mostly an opportunistic catch.

P40

Investigating the effects of anthropogenic lead pollution on the health and mortality of sub-adults within the Roman Empire

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Human exploitation of lead has an enduring history that stretches into antiquity, a history that is intimately intertwined with the insidious nature of the prized metal. For as long as people have utilised lead they have suffered the deleterious effects of lead poisoning. These are usually systemic and manifest as metabolic diseases and neurological deficits. As children are particularly susceptible to its toxicity, failure to thrive is common in afflicted infants. Due to the ubiquitous use of lead throughout the Roman Empire it is likely Roman populations suffered these adverse health effects. This research explores whether the Romans zealous use of lead contributed to the failure to thrive evident within Roman sub-adult skeletal populations. Trace element data obtained from 95 sub-adult individuals from four Roman skeletal assemblages shows a negative correlation between lead concentrations and age at death. The median lead concentration in the sub-adult individuals was almost double the median value recorded in adults from the same skeletal assemblages (adult median 2.8 ppm, sub-adult median 5.4 ppm). Furthermore, when compared with palaeopathological data higher lead concentrations were also observed in individuals that exhibited osteological evidence of metabolic disease (median = 8.1 ppm) than those that did not (median = 5.1 ppm). This preliminary data suggests that lead exposure may be a contributing factor in the preponderant failure to thrive seen in many Roman skeletal populations and offers new insights into the impact of anthropogenic lead exploitation on childhood health within the Roman Empire.

P41

The massive production and distribution of metal in the Bronze Age: the case of Peñalosa and the Argaric Culture in the Iberian Peninsula

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This paper presents the results of the analytical studies carried out on the archaeometallurgical remains of Peñalosa (Jaen, Spain), a settlement of the so-called Argar Culture in the Bronze Age, located in the south of the Iberian Peninsula. The debate on the scale of copper production in the south of the Iberian Peninsula during the Recent Prehistory has focused on the role of metallurgy in the social development of these communities. Peà±alosa has provided an interesting archaeometallurgical record that has characterized the whole transformation process of copper ore into metal, from its extraction in the near mines to reduction, casting and finishing processes of objects. The lead isotopes analyses have determined the exploitation of a series of copper and lead ore metallotects near the site. Equally, the XRF, XRD and SEM analyses have corroborated the technological level reached by these populations in the reduction and smelting tasks. On the other hand, metallography indicates the working conditions to which the pieces were subjected at the time of their manufacture. However, indicators of the large-scale copper exploitation are determined by the following facts:

- The presence of a large dumping site placed outside the settlement in which all the materials are metallurgical.
- The existence of a great variety of ingot molds and metallic ingots that point out a massive production.
- The analytical results seem to indicate an expansion of the copper and silver metal from Sierra Morena to the rest of the southern peninsular.

P42

Technological Aspects of Iron Production at Skógar, Iceland AD 940-1305

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This study presents the results of an analysis of ironmaking remains from the early medieval site of Skógar in northern Iceland. A full range of archaeological remains- ore, slag, bloomery iron, and furnace materials- were subjected to analyses by SEM-EDS, metallography and FTIR to deduct technical parameters of ironmaking at the site, as well as to assess the scope of production, and to place the site in a wider context of Norse ironmaking. The study of slag showed consistent production parameters, fitting well with the established knowledge of Norse ironmaking. Investigation of furnace materials- clay and stone- revealed that a distinct change occurred throughout the four centuries of production at the site; bone and bone remains were found in connection with all of them for the first phase (c. AD 940-1100), but not for the second phase (c. AD 1100-1305). The chemical composition of ore and slag indicates that the iron makers at Skógar used a variety of bog ore sources in the surrounding area, which in turn influenced the potential output quantities, depending on which combinations of ore were used.

Over the four centuries iron was made at Skógar, the archaeological remains show a consistent method for ironmaking. However, the earlier use and later abandonment of bone as ceramic temper but also as a possible additive to the charge points towards a larger transition taking place. The precise role of bone in the smelting charge remains to be investigated further.

P43

Method development in palaeoclimate and palaeoseasonality reconstruction using oxygen isotopic analyses of bioapatite phosphate of faunal remains

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Climatic conditions such as temperature are the most prominent driving forces of oxygen isotopic composition of meteoric and open water sources, the isotopic signatures of which are passed on to the bioapatite of teeth and bones of obligate-drinking mammals. In this way, oxygen isotopic analyses of faunal remains have tremendous, but so far largely untapped, potential as terrestrial archives of palaeoclimate and palaeoseasonality information, offering supra-annual mean (bone) and intra-annual (tooth) resolution at Palaeolithic sites. A better understanding of environmental conditions at this more local/regional level is pivotal to a more nuanced discussion of hominin adaptive strategies, as it provides a much needed contextualizing framework. However, despite this potential, oxygen isotopic analyses of herbivore teeth and bones present several methodological challenges that require more in depth exploration to allow refined palaeoseasonality and palaeotemperature reconstruction. Central methodological issues are related to sample pretreatment, sampling strategy and the expression of seasonal isotopic effects in biological tissues. Here we present strategies for systematic exploration and alleviation of such problems, focusing particularly on pilot data on the effects of organic removal pretreatments, the necessity and method of which have been controversially discussed for the past two decades. Specifically, the study presented here seeks to further clarify the mechanisms behind the effects of different pretreatment techniques on mammalian tooth and bone by use of a large scale systematic approach incorporating spectroscopic.

P44

Ancient Egyptian mummy genomes suggest an increase of Sub-Saharan African ancestry in post-Roman periods

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Egypt, located on the isthmus of Africa, is an ideal region to study historical population dynamics due to its geographic location and documented interactions with ancient civilizations in Africa, Asia, and Europe. Particularly, in the first millennium BCE, Egypt endured foreign domination leading to growing numbers of foreigners living within its borders possibly contributing genetically to the local population. However, methodological problems and contamination obstacles have hitherto hampered direct investigations of ancient Egypt's population history using ancient human DNA. Here we present mtDNA and nuclear DNA from mummified humans from Middle Egypt recovered with High-throughput sequencing methods that span around 1,300 years of ancient Egyptian history from the Third Intermediate to the Roman Period. Our genetic transects reveal that ancient Egyptians shared more ancestry with Near Eastern populations than present-day Egyptians, who admixed with Sub-Saharan populations in more recent times. This analysis establishes ancient Egyptian mummies as a genetic source to study ancient human history and opens the perspective of deciphering Egypt's past at a genome-wide level.

P45

ST. CROSS: Hillfort Settlement in Istria (Croatia) at the End of the 2nd Millennium BC

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Due to its exceptional geographical position on the crossroads of ancient paths, the Istrian peninsula (northern Adriatic) was an important link between east, west, north and south ever since the prehistoric times. The micro region around the Mirna River (lat. Ningus flumen) in northern Istria (Croatia) was inhabited from the prehistoric times. St Cross (S Croce) represents a dominant angle (370 m of altitude) situated on the northern slopes of the Mirna valley right by Završje (Piemonte d'Istria). It is a multi-layered archaeological site with the oldest traces reaching back to the Neolithic period. The site itself was populated during Bronze and Iron Ages and all through the Roman period and the Middle Ages. Croatian Conservation Institute conducted the rescue archaeological research on this site in 2011. Four trenches were excavated. It has been confirmed that the layers abound in prehistoric material as well as remains of residential architecture (especially referring to ceramics). The material from closed units i.e. pits is very important in the site's time orientation. The so called water sieving and flotation methods had been conducted on this sediment. These methods resulted in valuable information which could not be collected through classical archaeological research. These pits, together with most other stratigraphical units belong to the late Bronze Age and early phase of Iron Age in Istria (13th to 10th century B.C.). This paper will try to show findings and reconstruct the way of life in the mentioned period.

P46

Chemical mapping of glass corrosion layers by PIXE/PIGE

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This study focuses on chemically mapping three corrosion layers by Particle Induced X-Ray Emission and Particle Induced Gamma-Ray Emission (PIXE/PIGE) of 13th - 14th century AD glass fragments from Miranduolo, Italy. All the samples can be classified as Na-Ca-Si glasses. MD 139 is made with natron as a flux but with high magnesia content (HMgn-Na-Ca-Si), while MD 143 and MD 259 are made with unpurified Levantine plant ash as a flux (ULpa-Na-Ca-Si). The morphology of the corrosion layers of the two latter samples is parallel, while of the MD 139 is hemispherical. In general, chemical mapping displays heterogeneous composition of the corrosion layers. The chemical map of MD 259a clearly displays three distinctive stratification layers with diverse composition. The results indicate a slow progression of the corrosion layer with enrichment and depletion that is generally common for only several elements. MD 259b two stratification layers can be distinguished, although the map of Si displays three layers. The average quantification results are consistent with LA-ICP-MS.

P47

Archaeovitreology and current issues

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The increase of the studies concerning ancient glass artifacts has raised the need to propose a common term to be use by all the specialists. Archaeovitreology implies the study of history and prehistoric use and production of: 1. man-made non-vitreous artifacts that are a product of glass production, and 2. man-made vitreous products: glasses, glazes, enamels and faiences. It should be considered as a sub-discipline of Archaeology and Archaeological Science implying the use of physico-chemical methods and techniques in order to determine all the characteristic features that can reveal more information on environmental, technological, socio-economic, political and ideological contexts.

Issues encountered in current papers considers several aspects that have to be addressed and/or discussed publicly. These issues include: focus either on the technique or on the artifacts, not presenting interdisciplinary interpretations; lack of optimization procedures tested on ancient materials; negligence of the importance of the descriptive and visual presentation of the object analysed, as well as the context from which objects were recovered; lack of uniform, consistent and applicable classification protocol and taxonomy; and lack of the availability of the data in form of an easy-access database.

The aim is to encourage discussion, dialogue, collaboration and consensus between archaeovitreologists. As a final result, less time consuming analyses, better data availability and data interpretation should be realized.

P48

A Parasite's Papuan Past: reconstructing age and origin of Plasmodium vivax malaria in Melanesia

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Plasmodium vivax (Pv) malaria is geographically the most widespread of human malaria species. Globally, Pv exhibits considerable genetic diversity, the origins and drivers of which are still largely unknown. It is likely that some of this diversity can be attributed to the long evolutionary history of Pv and association of its distributions with past human migratory movements. To this effect, we have focused on understanding the origin and age of the highly variable Pv in and around Melanesia, through mapping the diversity in mitochondrial genomes from >200 Pv samples from Papua New Guinea, Solomon Islands and Vanuatu. Findings have then been related to the major past human migration events in the region, namely: Papuan (from ~60,000 years ago) and Austronesian (from ~6,000 years ago). Understanding the mutual past of Pv and humans across Melanesia is of interest due to the pronounced genetic diversity found in both, including genetic adaptations to malaria present in all pre-European human populations. Several of these adaptations suggest a long, continued history of exposure. Current results show Melanesian Pv populations carry closely related mitochondrial genome haplotypes that are significantly distinct from the main haplotypes in neighbouring East and South East Asia; more closely related to those in Africa and South Asia. These findings and the estimated age of ~65,000 years for the Melanesian Pv clade indicate a Papuan introduction. We will discuss the implication of these observations further in the context of our knowledge of human colonisation around Melanesia.

P49

Challenging the Assumptions in Isotopic Profiling of herbivore teeth: a modern comparative intra- and inter-lobe study of the Chillingham cattle

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Fully understanding a method, and any associated assumptions, is imperative before applying it to the finite archaeological record. One such assumption, made during the isotopic analysis of tooth enamel, is that multiple lobes of the same tooth have the same isotopic profile. This study tests this supposition by analysing x-radiographs of known-age modern cattle mandibles to assess intra-molar formation times, and producing $\delta^{13}C$ and $\delta^{18}O$ intra-tooth profiles of six modern cattle molars from the highly homozygous Chillingham herd. The results show that while the mineralisation of adjacent lobes of a tooth is staggered, no systematic temporal isotopic offset was found between them. However, variations of up to 2.4‰ were obtained in the $\delta^{18}O$ values between enamel samples the same distance from the enamel-root junction on adjacent lobes of the same tooth. Variations in $\delta^{13}C$ values of up to 1.7‰ were observed when the two lobes of the same tooth were sampled using different protocols and measured on different mass spectrometers. The teeth from the static Chillingham herd had not been buried; environmental factors resulting from long-distance animal movement during tooth mineralisation, genetic breed differences, and diagenesis can be ruled out. Intra_individual biological factors and differences in methodology are proposed as the most likely cause. However, a wider data set is needed to determine the factor(s) responsible for the variation. Nevertheless, this study highlights the potential pitfalls of interpreting small differences between data points, even when they exceed analytical error, and suggests a method for overcoming this obstacle.

P50

Using acetate to replicate ground and polished stone surfaces

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Archaeologists frequently face limitations when analysing the use-wear of an implement. In particular, most museums will not allow their collections to be removed and taken to a suitable laboratory for analysis. This can be a major drawback; often microscopes can't be transported due to their size and fragility, therefore alternative methods of analysis are required. The most common method uses a dental casting product, Provil®, to replicate the wear on the surface of the implement. The resulting cast is easily transported and small enough to fit under a microscope, thus not needing an extendable arm – larger implements do not fit underneath a 'regular' sized microscope. However, despite several benefits of using this method, and its common use, there is a drawback which disables its use on a large group of implements – ground and polished stone. The use of Provil®, or other similar products that have a silicone base will leave a greasy stain upon the implement under question when it is removed. This problem affects porous stones the most, thus most ground stone implements are affected while those made of flint, metal, and bone are not affected. A solution lies in the use of acetate film, although it does not replicate wear patterns as well as the Provil®, being fragile, and often not reaching the lower interstices. There are few published works relating to the methodology of using acetate film to replicate wear on an implements surface. This poster presents testing of Knuttson and Hope's method (1984) in addition to the creation of a new methodology, more suitable for the replication of wear on ground and polished stone surfaces.

P51

Identifying Dietary Reads in Dental Calculus

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Dental calculus is often found on the teeth of archaeological human remains, and has been shown to preserve ancient biomolecules. The calcification process entraps both the bacteria from the oral microbiome, but also particles of ingested food, providing direct evidence of consumption. As such the study of dental calculus can complement established methods like stable isotope analyses and provide a more complete picture of ancient diets and subsistence strategies. This study aims to explore and optimize current methods for identification of dietary DNA sequences in ancient dental calculus. Although there is a growing interest in dental calculus as a substrate for biomolecular work, the identification of dietary DNA sequences presents a challenge that has yet to be properly addressed. Aside from the inherent obstacles of working with ancient DNA, the proportion of dietary reads is minute even among the endogenous constituent. Consequently, detecting and authenticating these sequences can be computationally intensive. Identification is further complicated by observed biases using traditional bioinformatic approaches, where bacterial sequences are wrongfully assigned as dietary even when blasting using high stringency. These issues reduce the confidence with which dietary sequences can be assigned. Here we compare a range of bioinformatic approaches for identifying and authenticating dietary reads from ancient dental calculus samples, and present an optimized but conservative method for identifying putative dietary sequences.

P52

Different People, Same Communities: a multi-isotope approach at the onset of social complexity in the Western Pyrenees (Basque Country, Spain)

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Carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) stable isotopes analyses from bone collagen provide information about the dietary protein input, while strontium isotopes ($^{87}Sr/^{86}Sr$) from tooth enamel may give us data about individual provenance and territorial mobility by past populations. To date, there is an absence of the combination of these isotopes on the Prehistory of the Western Pyrenees, helping therefore this study to fill in the gap with new data from the Basque Country. We here report human and faunal values from the Chalcolithic burial sites of Fuente Hoz (Anuntzeta, Araba) and Kurtzebide (Letona-Zigoitia, Araba). Our results show that humans with both local and non-local strontium signatures were buried together at the sites, and suggest similar resource consumption based on C3 terrestrial resources that included domestic animals (i.e. ovicaprids, bovids and suids) as a main part of the protein input. Overall, this study sheds light on how individuals from different backgrounds were still buried together and shared a same "dietary life-style" at the time in the Prehistory of Iberia when social complexities started to unravel.

P53

Investigating the nature and timing of the earliest human occupation of North America using a novel integration of biogeochemistry and micromorphology

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Coprolites contain a suite of biomolecules and microfossils, making them incredibly useful palaeoenvironmental and palaeodietary archives. The short-term nature of their production within the human body offers a very high temporal resolution, contrasting with traditional dietary proxies in archaeology such as skeletal C/N isotopes, which give an average lifetime signal. Some of the earliest evidence of human occupation in North America is a coprolite from Paisley Caves (Oregon, USA) which contained ancient human DNA in a matrix dated between 14,170 to 14,340 cal BP. However, there have been debates over the stratigraphic integrity and preservation of the aDNA. This debate is difficult to resolve as there is currently little understanding of the nature of biomolecule taphonomy and movement within the cave environment. Before broader questions of palaeodiet and resource use of these early settlers can be investigated, the identification of coprolite proxies as human or otherwise must be confirmed, and their stratigraphic integrity assessed. This research aims to address these issues by using a novel integration of biogeochemistry and sediment microstratigraphy to investigate the survival and taphonomy of different biomolecules within the cave environment and to understand how these early settlers interacted with their seasonal environment.

P54

Mapping 450 year-old marine archaeological iron corrosion from the Mary Rose

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The conservation of archaeological iron is a serious challenge, particularly for objects buried in a marine environment. Artefacts are typically unstable and continue to deteriorate in the museum environment or store. Conservation treatments for archaeological iron aim to stabilise the metal through the removal of chloride, Cl-, from corrosion products using a number of desalination techniques. However, the impact of treatment methods on the chemistry, structure and elemental distribution of the corrosion layer as it progresses through an artefact has yet to be thoroughly explored. This work is part of a larger project investigating the corrosion of 1,248 cast iron shot from the Tudor warship the Mary Rose using a combination of laboratory- and synchrotron-based methods. In this poster, the results of the first stage of the study is presented; an analysis of shot stored in alkaline solution for ~34 years. Preliminary results from elemental analysis suggests that no detectable Cl- remains in the artefacts after long-term soaking, while diffraction studies have not identified chlorinated corrosion phases. A cross-section cut from one ball has been examined with the complementary techniques powder X-Ray Diffraction and X-Ray Absorption Spectroscopy, which shows that the predominant products are magnetite, Fe3O4 and goethite, α-FeOOH, in changing distributions across the artefact and within the corrosion layers. Overall, this study looks at the impact of long-term immersion on archaeological iron corrosion, an under-studied area with important implications for conservation.

P55

Prehistoric Drywall Architecture: Reconstruction of Form and Function

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Remains of drywall architecture dated to the second half of the 3rd Millennium BCE were unearthed during rescue archaeological excavation at the Pod site, a small valley surrounded by higher hills in the Bukovica region of Dalmatian hinterland in present-day Croatia. As architectural remains from the period in question are relatively rare and as it is widely accepted that elevated positions were preferred during that time, this type of lowland settlement remains can offer a significant contribution to our understanding of regional landscape usage. The excavation covered only a part of the preserved remains, but their spatial relations and specific variations in construction suggest significant differences in form and function. Furthermore, their occurrence in the region which is characterised by rugged karst formations, scarce water sources and rare karst fields suggests a specific impact of natural conditions on human activities, probably similar to that which until recently was easily observed. Analysis of the landscape and natural conditions, as well as consideration of ethnographic analogies, which provide information about the construction and usage of drywall architecture, as well as the life in the region during more recent time periods, gives the possibility to propose the reconstruction of appearance and interpretation of function of the excavated remains. Along with the analysis of recorded differences in the distribution of ceramic material collected at the site, better understanding of drywall architecture usage in given spatial and temporal framework can be obtained.

P56

New developments for the study of cremated bone in archaeological contexts

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Due to the very high temperatures reached during cremation (up to 1000ºC and more) it has generally been assumed that the traditional stable isotope methods used on unburned bone are not applicable to cremated bone. However, various studies have shown that cremated bone provides a reliable substrate for radiocarbon dating and strontium isotope analyses. This poster presents the results of on-going research on the carbon, oxygen and strontium isotope ratios of calcined bone ($\delta^{13}C_{ap}$, $\delta^{18}O_c$, $\delta^{18}O_p$, $^{87}Sr/^{86}Sr$), REEs, infrared and µXRF analyses. By looking into these different parameters it is possible study landscape use and mobility patterns at sites where cremation was practiced. It also allows investigating changes from marine to terrestrial diets as well as cremation practices. These new developments have been successfully applied to archaeological sites from Mesolithic, Neolithic and Bronze Age Ireland and UK. This poster presents and compares the results from these different sites and discusses their implications and future research.

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A modern red deer population from Spain investigated through intra-tooth sequential isotope ($\delta^{13}C$ & $\delta^{18}O$) and tooth microwear analyses: using data as palaoecological and seasonality proxy

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A modern red deer (Cervus elaphus) population from the Valsemana hunting center (Leon, Spain) has been investigated through intra-tooth sequential isotope ($\delta^{13}C$ & $\delta^{18}O$) and tooth microwear analyses. Second and third molars were selected for analyses from a set of sixty specimens hunted around 2 years old. Intra-tooth isotopic variation in $\delta^{18}O$ values is investigated to test potential utility to infer seasonal reproductive patterns. Data from microwear analyses and sequences of $\delta^{13}C$ values are used to construct a reference data set on a seasonal basis to infer changes in diet throughout the year. The preliminary results here presented will be useful to investigate ongoing archaeological specimens in forthcoming studies.

P58

A new interpretation of Villa della Farnesina wall paintings in light of earlier dating linked to Cleopatra's presence in Rome between 46 and 44 BC

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Currently, there is cause to question the accuracy of dating of the Phase II of the Second Pompeian Style, established by Hendrik Gerard Beyen (within the house of Livia, house of Augustus and Aula Isiaca). The current study and my recent research allow for an earlier dating and also reveal a dramatic break with wall-paintings belonging to Phase I. The clearest proof of this break must certainly be the Roman villa discovered under the garden of the Villa della Farnesina. I propose that this stylistic shift can be detailed via the following four points: first, the introduction of mythological tableaux situated at the centre of each wall; second, the integration of Egyptian themes into the typical ornamental repertoire; third, the use of 'motivi miniaturistici'; fourth, the eclecticism with which iconographic and stylistic references are juxtaposed. Working on the villa della Farnesina, Eugenio La Rocca demonstrated that the house had in fact been constructed and decorated much earlier than first believed. He proposes the new date of the decade following 40 BC introducing the hypothesis that the stylistic 'break' can be attributed to the presence of Cleopatra near Rome accompanying Caesar between 46 and 44 BC. The queen very probably was accompanied by artists working for her in the royal Alexandrian workshops. It is likely, therefore, that the Roman elite would have replicated the styles and tastes of Caesar and Cleopatra by commissioning these artists to decorate their dwellings in the style introduced by the Egyptian Queen.

P59

Burial caves, shared spaces, subsistence and territorial mobility during the Neolithic in the North-East Iberian Peninsula: A multi-isotope approach

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The Ebro Basin is an excellent territory to explore prehistoric subsistence patterns linked to territorial mobility and use of the environment in the past. We here apply a multi-isotopic approach in order to retrieve information from Neolithic and Chalcolithic lifestyles. In this context, four Sepulchral caves dated between the VIth and IIIrd millennium cal BC located in the Ebro Basin (north-eastern Iberia) have been studied. Carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) stable isotopes from 77 humans and 104 animal bone remains and strontium isotopes ($^{87}Sr/^{86}Sr$) of 84 human tooth enamel samples from 59 individuals were analysed. The bioavailable strontium range values from the region and immediate surrounding of the study sites were calculated by analysing archaeological microfauna teeth, modern plants and snail shells. Moreover, 8 new radiocarbon dates were obtained to further tighten the chronological background of the material studied. Overall, carbon and nitrogen isotope ratio results from all sites show a quite homogeneous diet that was based on C3 terrestrial resources, with no evidence of isotopically-detectable marine protein input from any individual. Strontium isotope ratio analysis identify 13 individuals (22%) as non-locals: 1 out of 2 from the Early Neolithic, and 11 out of 57 from the Late Neolithic/Chalcolithic periods. There is no evidence of any sex nor age-based difference amongst the individuals. These data provide new information on the socio-economical structure during different stages of the Neolithic period in a same region from northeastern Iberia.

P60

Lipid Analysis of Pottery from Ayia Triada Cave, Greece: Evidence for Ritualized Consumption?

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Excavations at Ayia Triada Cave, located on the southern tip of Euboea Island, Greece, have provided evidence for the burial of at least nine individuals in the Early Bronze Age period. On the basis of intentionally smashed and arranged pottery and a thick layer of carbonized plants and animal bones, it has been suggested that feasting occurred in the cave prior to the burials. Further evidence could lend support to this interpretation. Exceptional preservation of the floral and faunal material excavated from the cave suggests that the cave environment was ideal for the preservation of organics absorbed within the pottery as well. This study employs a multidisciplinary approach via organic residue analysis of pottery found in the cave to investigate possible food/drink consumption and feasting practices. Over a hundred samples of Ayia Triada jars, storage pots, and bowls were collected and analyzed to determine their original organic contents. Total lipids were extracted, fractioned, and analyzed by gas chromatography and mass spectrometry, a combined technique that separates complex organic mixtures into constituent compounds for identification. Since scant settlement remains dating to the Early Bronze Age have been excavated in the region, diet and consumption patterns of the early inhabitants have been difficult to investigate. This poster will present highlights of the lipid analysis results, further characterize the evidence for ritualized feasting in the cave, and reveal new details of diet and resource exploitation by the people who once inhabited Southern Euboea.

P61

Hotspots in the landscape: the application of geochemical and geophysical prospection to locate high-temperature production in early Islamic towns.

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This paper examines the combination of in-situ portable X-Ray Fluorescence (pXRF- Niton XL3TGOLDD+), and magnetic survey data obtained from the 10th century, early Islamic site of Madinat al-Zahra in Cordoba, Spain. The work presented here forms part of a larger research project that investigates the key role that glass, ceramic, and metal production had in the creation of urban centres, and the important question of technology transfer between Muslim, Christian and Jewish groups within Spain and in the wider Mediterranean at this time. Results are presented that demonstrate how this novel approach to site-wide prospection has identified a range of likely production areas within the medina (city) at Madinat al-Zahra. Elemental 'hotspots' obtained from a relatively coarse pXRF survey of the top-soil at the site are seen to be directly linked to substantive magnetic anomalies that have geophysical signatures suggestive of high-temperature activities. Iron working and probable ceramic production were located, and specifically areas of elevated lead, copper and manganese were found to be linked to the remains of furnaces that may have produced the famous glazed ceramics known to be manufactured on the site. The results move beyond enabling a more nuanced approach to the interpretation of geophysical datasets, and towards an integrated archaeological prospection tool on a site-wide level.

P62

A three-dimensional geometric morphometric study of coastal erosion and its implications for biological profiling and biomechanical inferences of fossilised footprints from Formby Point, Merseyside.

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Fossilised footprints have long held a fascination in anthropological studies. Footprints are frequently used to inform upon the biological profile of the track-maker and upon foot/lower limb kinematics. However, rapid erosion limits the wealth of knowledge that can be extracted. In June 2016 over 700 Mesolithic human and animal footprints were discovered along the Formby Point coastline. Within just one week tidal action had completely eroded the sediment beds. The rapid erosion of the footprints have offered a unique opportunity to quantitatively assess the effects of daily degradation on footprint morphology, and its effect on biological profiling or biomechanical inferences. Photogrammetry was applied daily to a selection of human and animal footprints. Three-dimensional Geometric Morphometric methods were subsequently applied to each model. Results indicate that prolonged exposure will increase the chance of error in biological profiling or kinematic analyses. The borders of the human footprint progressively receded, increasing the length and width of the print. A significant change in footprint measurements proves problematic for predicting stature, mass, sex, and kinematic analyses. Further, human and animal footprint depth, often used to inform upon speed and kinematics, varied considerably in one week. Some regions of the footprints became much shallower, whilst other regions increased in depth. Rapid recording of fossilised prints from first exposure is recommended for reliable data to remain viable. Delay in excavation and recording will negatively affect any inferences. The use of photogrammetry allowed for extensive post-excavation analyses and the digital preservation of fragile fossils.

P63

Characterizing Mobility in Times of Transition: An Investigation of Roman and Byzantine Populations at Hierapolis, Turkey

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The Roman and Byzantine periods in Turkey are characterized by substantial societal change, including the end of the Roman Empire and the spread of Christianity. At the World Heritage site of Hierapolis, we investigate the mobility of Roman (Roman/Early Byzantine, 1st c. - 7th c. AD) and Byzantine (Middle Byzantine, 9th - 13th c. AD) individuals (n=47) using strontium analysis. Results from Roman and Byzantine individuals show that while the majority of the population interred at this site is local, there are some significant outliers that signify migrant individuals. This corroborates with the history of pilgrimage at Hierapolis during these time periods as well as with the archaeological evidence of pilgrimage badges and coins unearthed from recent excavations. Additionally, the first bioavailable strontium map covering southwestern Turkey is presented and human results are interpreted using this newly created strontium isoscape map.

P64

Climate change, rodents and camelids: Assessing subsistence strategies during the Early and Middle Holocene in the Dry Puna through stable isotope analysis

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The Southern Andes were peopled around 12.000 years BP, during a period characterized by a humid and stable climate changing to more dry and unstable climatic conditions in the Middle Holocene (8000–3500 years BP). The aim of this work is to explore stable isotope compositions of vizcacha (Lagidium viscacia) bone remains recovered in archaeological sites located in the Dry Puna of Argentina and dated between 10,000 and 6000 years BP, in order to explore the consequences of climate change on the subsistence strategies employed by hunter-gatherer groups that inhabited this area during the Early-Middle Holocene transition. In this sense, we consider that stable isotope compositions measured on specific animal species, such as small rodents, can provide information about ecosystem modifications dictated by climate change, particularly during the Early-Middle Holocene transition. On the other hand, the isotopic analysis of wild animals' tissues can help us to investigate hunting strategies employed by human groups that inhabited this area in the past. Thus, this work presents $\delta^{13}C$ and $\delta^{15}N$ values measured on bone collagen extracted from Andean vizcacha remains recovered at Hornillos 2 (4050 masl) and Inca Cueva 4 (3650 masl), two archaeological sites of the Dry Puna of Argentina dated to these time periods. At the same time, we compare these results with the $\delta^{13}C$ and $\delta^{15}N$ values measured on modern plant species collected near the archaeological sites surveyed and the $\delta^{13}C$ and $\delta^{15}N$ values measured on archaeological camelid species (Lama and Vicugna spp) recovered at the same sites.

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